DOCUMENT RESUME

ED 282 730 SE 048 153

TITLE	Biennial Conference on Chemical Education: Abstracts of Papers (9th, Bozeman, Montana, July 27-August 2, 1986).
PUB DATE	86
NOTE	159p.
AVAILABLE FROM	Dr. Kenneth Emerson, Chemistry Department, Montana State University, Bozeman, MT 59717 ($7.50).
PUB TYPE	Reports - Descriptive (141) -- Collected Works - Conference Proceedings (021)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Chemistry; *College Science; Computer Uses in Education; Demonstrations (Educational); *Elementary School Science; Elementary Secondary Education; Foreign Countries; Higher Education; Problem Solving; *Science and Society; Science Education; *Science Instruction; *Secondary School Science; Teacher Education; Videodisks

ABSTRACT

This document includes summaries of conference presentations dealing with a wide variety of topics, including chemistry units for the elementary classroom, science experimentation in the secondary school, computer simulations, computer interfaces, videodisc technology, correspondence teaching of general chemistry, interdisciplinary energy courses, training chemical technicians, atomic structure, inexpensive visual aids, hazards in the chemistry laboratory, gifted and talented chemistry programs, inservice teacher training, computer assisted instruction, problem solving in chemistry, the microscale organic laboratory, applied learning theory, writing across the curriculum, teaching assistants, chemistry demonstrations, and undergraduate curricula. The schedule for each day of the conference is provided, followed by the abstracts submitted for papers presented in each section. (TW)

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9TH BIENNIAL CONFERENCE ON CHEMICAL EDUCATION

ABSTRACTS OF PAPERS

THE BUFFALO BIENNIAL

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27 JULY - 2 AUGUST

BOZEMAN, MONTANA

SE 048 153

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MONDAY, JULY 28, 1986

Plenary Sessions

See condensed schedule for room locations

7:00PM Sunday, July 27th
PL-01
THE LOGICAL STRUCTURE OF MODERN CHEMISTRY, OR WHAT CHEMISTS REALLY DO
Hoffmann R

8:00AM Monday, July 28th
PL-02
PEER PERSPECTIVES ON TEACHING SCIENCE
Tobias S

8:45AM Monday, July 28th
PL-03
CHEMISTRY FOR KIDS: MAKING IT MEANINGFUL
Gabel DL
Kid

6:50PM Monday, July 28th
PL-04
OPPORTUNITIES IN CHEMISTRY: THE PIMENTEL REPORT
El Sayed M

6:50PM Tuesday, July 29th
PL-05
TOMORROW: THE YANKWICH REPORT
Yankwich P

8:00AM Tuesday, July 29th
PL-06
THE MINATURIZATION OF ORGANIC LABORATORY PROGRAMS
Mayo DW

9:30
Questions

PL-01 THE LOGICAL STRUCTURE OF MODERN CHEMISTRY, OR WHAT CHEMISTS REALLY DO. Roald Hoffmann, Department of Chemistry, Cornell University, Ithaca, New York 14853

When chemists speak of their work they tend to emphasize the technological achievements of their science, a division into traditional sub-disciplines such as organic or inorganic chemistry, and a classical scientific methodology. This lecture will stress the logical and intellectual content of modern chemistry and how the realities of research in this science depart from the classical model. The activities of chemists are perhaps best classified in terms of analysis, including structure determination; the determination of mechanisms of reactions; theory; and the synthesis of molecules. The concept of molecular structure is pervasive in chemistry. These modes of chemical research will be illustrated by example. An argument will be made that there exists a unique logic of chemistry, and that understanding in chemistry is rarely reductionist.

PL-02 PEER PERSPECTIVES ON TEACHING SCIENCE, Sheila Tobias.

Sheila Tobias is a specialist in the area of mathematics anxiety. She is currently applying her expertise to the problem of similar learning difficulties in the area of science. Her most recent investigations have been in the discipline of physics, and she plans to extend her investigation to chemistry.

PL-03 CHEMISTRY FOR KIDS: MAKING IT MEANINGFUL. D. L. Gabel, School of Education, Indiana University, Bloomington, Indiana 47405.

Most chemists know how to make chemistry fun for kids. What child would not be interested in the "Blue Bottle" experiment, the iodine clock reaction, color changes of acid-base indicators, liquid nitrogen, dry ice, hydrogen balloon explosions, etc. etc. etc.? With the proliferation of chemistry programs for children during the past few years, the real question that chemists must ask is: Is it enough to make chemistry fun for kids, or do we also want to make it meaningful? Is chemistry just another bag of tricks that a magician does, the workings of which are incomprehensible to the viewers? Or is chemistry the study of matter and the changes it undergoes? This presentation will contrast what children know and believe with what they are"expected" to know. It will show how to take awesome demonstrations and experiences and make them meaningful learning experiences upon which other chemistry concepts can be built.

PL-04 OPPORTUNITIES IN CHEMISTRY: THE PIMENTEL REPORT. El Sayed M.

A brief formal presentation on the NAS Report, "Opportunities in Chemistry", followed by open discussion.

PL-05 TOMORROW: THE YANKWICH REPORT. Yankwich P.

A brief formal presentation on the ACS-SOCED Report, "Tommorrow", followed by open discussion.

PL-06 THE MINATURIZATION OF ORGANIC LABORATORY PROGRAMS, Dana W. Mayo, Ronald M. Pike*, Samuel S. Butcher, Department of Chemistry, Bowdoin College, Brunswick, ME 04011.

The spectacular success of trial sections argues strongly for the miniaturization of the introductory organic laboratory program. In addition, the reduction or practice of microscale laboratory procedures has resulted in major benefits beyond the expected improvements in laboratory air quality. Microscale programs have the potential to result in: (1) 100 to 100 fold reduction in the quantity of starting material, parallel reduction in organic solvents required. The contraction in scale dramatically reduces the demand on the laboratory ventilation system; (2) a sharp decrease in student contact with toxic materials of all types; (3) essentially elimination of explosion or fire hazard; (4) a reduction in the cost of chemicals; (5) an opportunity to expand the available variety of experiments; (6) reduction of waste disposal costs; (7) the option of being able to locally synthesize adequate supplies of reagents and starting materials not commercially available; (8) operational cost reductions; (9) a number of significant pedagogic advantates. The close interrelationship of techniques required in the microscale laboratory with those of analytical chemistry reinforces parallel laboratory experiences. Finally, employing this approach allows many laboratory operations to be carried out in far less time. Students are able to carry our more manipulations per laboratory period. Students rapidly develop powerful laboratory techniques including expanded versatility with modern chemical instrumentation. We expect to cover nearly double the organic chemistry of the current macroscale laboratory.

Scheduled Discussions and Special Events

8:00PM Tuesday, July 29th, 234 Gaines Hall
DS-01
Discussion, TEACHING PRE-NURSING CHEMISTRY
Wilson A

8:00PM Tuesday, July 29th, Strand Union Ballroom - C
DS-02
Discussion, EXAMINATIONS COMMITTEE GENERAL CHEMISTRY EXAM
Hawkes S

8:35AM Wednesday, July 30th, Strand Union Ballroom - C
DS-03
Panel Discussion, CRITICAL ISSUES IN THE TWO-YEAR COLLEGE CHEMISTRY: AFTERMATH OF THE 1985 INVITATIONAL CONFERENCE
Susskind TY

2:30-5:00PM Tuesday, July 29th, 207 Gaines Hall
SE-01
Special Event, TOUR OF MICROSCALE ORGANIC EXPERIMENTS
Mayo DW

DS-01 Discussion session Chemistry for pre-nursing students

Organizer- Anna M. Wilson
Biochemistry Department
Purdue University
West Lafayette, IN 47907

This group will meet to discuss the ways to teach chemistry to students enrolled in courses of study for health professions. Included are pre-nursing, nursing, medical technicians, physical therapists, etc. Included subjects will be: what topics of chemistry should be taught, when and why: examples to use in class that are relevant to their interests; arguments to keep a separate chemistry course for these students; and what the health professions want their new members to know. This discussion group is sponsored by the Chemistry Education Division Committee on Chemistry Education for Health Professionals which will have several members present to discuss their approach to the above topics. Anyone with questions or suggestions on any of these or related topics is invited to attend.

DS-02 EXAMINATIONS COMMITTEE GENERAL CHEMISTRY EXAM, S. Hawkes.

The members of the Examinations Committee will lead a discussion of subject matter and content of the ACS General Chemistry Exam.

DS-03 "CRITICAL ISSUES IN TWO-YEAR COLLEGE CHEMISTRY": AFTERMATH OF THE 1985 INVITATIONAL CONFERENCE. T.Y. Susskind and Panelists, Department of Science/Health Education, Oakland Community College, Auburn Hills, Michigan 48057.

In November, 1985, the American Chemical Society sponsored an Invitational Education Conference entitled "Critical Issues in Two-Year College Chemistry". The goals of the conference were to identify the issues that have a critical impact on the teaching of chemistry in two-year colleges and to make recommendations to those capable of addressing these issues.

Panelists will describe the conference: its makeup, the issues that were identified, and the process that led to specific recommendations. The recommendations will be discussed by panelists and respondents. Conferees will be given a chance to react to the recommendations.

SE-01 TOUR OF MICROSCALE ORGANIC EXPERIMENTS, DW Mayo.

This event will be a display of microorganic laboratory glassware and equipment. Faculty from several institutions using this equipment will be on hand to talk to participants. Representatives from the manufacturer, Ace Glass, will also be present.

Kids Chemistry in Action

9:30-11:30AM Tuesday, July 29th, 228 Gaines Hall
KA-01
WORKSHOP FOR THE YOUNG STUDENT: AN ART EXPERIENCE
Coleman RR, Sturtevant FF

2:30-4:30PM Tuesday, July 29th, 203 Gaines Hall
KA-02
CHEMISTRY CAN BE FUN
Danieley JE

9:30-10:30AM Wednesday, July 30th, 302 Gaines Hall
KA-03
HOUSEHOLD CHEMISTRY FOR KIDS 6-15
Bridges B, Wilcox V

10:30-11:30AM Wednesday, July 30th, 302 Gaines Hall
KA-04
CHEMISTRY—A DISCOVERY SCIENCE
Sarquis AM, Smyth E

2:30-5:30PM
KA-05
"CHEMISTRY CAN BE FUN": AN I.C.E. ACTIVITY FOR MIDDLE SCHOOL STUDENTS
Jeurgens FH, Perkins RI, Gelder JI, Shaw DB, Spencer KM

KA-01 WORKSHOP FOR THE YOUNG STUDENT: AN ART EXPERIENCE, Robert Coleman.

Robert R. Coleman will conduct sessions for designing with natural forms - converting leaves to earrings and jewelry. He will also guide the students in design, graphite sketching, and preparation for the electroforming of their sketches in an electroplating tank. Each student will have a piece of art or jewelry to take home. All needed materials will be furnished.

KA-02 CHEMISTRY CAN BE FUN. J. Earl Danieley, Department of Chemistry, ELON COLLEGE, Elon College, North Carolina 27244

A series of demonstrations with lecture to familiarize fifth grade students with some familiar substances: oxygen, hydrogen, carbon dioxide. Students will be invited to be present for the presentation.

A series of experiments for students in grades 5 through 9 to give students some hands-on experience in the laboratory. Students enjoy titrating "Tums" and "Rolaids" to determine the amount of "stomach acid" such antacids will neutralize. They also enjoy seeing us prepare oxygen and hydrogen gases and demonstrating some of the properties of each gas.

KA-03 HOUSEHOLD CHEMISTRY FOR KIDS 6-15, Bette Bridges, Silver Lake Regional High School, and, Valerie Wilcox, Museum of Science Boston, Massachusetts

This is a hands-on workshop for the children, ages 6-15, of the conference registrants. It is a potpourri of demonstrations used successfully with these age groups in Discovery Classes and school classes at the Museum of Science in Boston and at Collegegate, a summer program for the gifted and talented, as well as in regular Physical Science classes at Silver Lake Regional High School. Among the activities planned are "oobleck", chalk chromatography, and investigation of common household substances.

KA-04 CHEMISTRY---A DISCOVERY SCIENCE. A. M. Sarquis, Dept. of Chemistry, Miami University-Middletown, Middletown, OH 45042.

A six-week Saturday program for Kindergarten-Fourth Grade students has been offered for the last five years, as a part of the Miami University's Winter - Kids in College. Details of the program will be presented and several of the hands-on activities shared with participants.

KA-05 "CHEMISTRY CAN BE FUN": AN I.C.E. ACTIVITY FOR MIDDLE SCHOOL STUDENTS. F.H.Juergens, R.I.Perkins, J.I.Gelder, D.B.Shaw, K.M.Spencer. Institute for Chemical Education, University of Wisconsin-Madison.

A five session laboratory program designed to acquaint middle school students with the wonders of chemistry has been in operation at the University of Wisconsin-Madison for over 4 years. It is planned to select several of the activities from this program, and offer them to children of conference participants in a one afternoon session. The session will be supervised by I.C.E. staff. A maximum of 30 children can be accomodated.

Conference participants are encouraged to observe. Complete sets of student instructions for all 5 sessions, plus an instructor's guide, will be available at a nominal charge.

MONDAY, JULY 28, 1986
Teaching Chemistry Using Computers
276 Strand Union Building

10:00AM
Introduction
Session Chair, **Cauchon P**

10:05
CC-01
COMPUTER-ASSISTED VIDEODISC LESSONS IN CHEMISTRY
Smith SG, Jones LL,

10:35
CC-02
A NEW WAY TO TEACH HIGH SCHOOL CHEMISTRY LABORATORY
Saltsburg H, Heist R, Olsen T

11:05
CC-03
THE SIMULATION OF LABORATORY EXPERIENCES
Lagowski JJ

11:35
CC-04
THE COMPUTER-ASSISTED BLACKBOARD
Soltzberg LJ

11:55
CC-05
CHEMISTRY LABORATORY REPORTS USING A SPREADSHEET COMPUTER PROGRAM
Torop W

12:10
Discussion, Questions

CC-01 COMPUTER-ASSISTED VIDEODISC LESSONS IN CHEMISTRY. Stanley G. Smith and Loretta L. Jones, School of Chemical Sciences, University of Illinois, 601 S. Mathews, Urbana, IL 61801

A series of interactive video disc lessons in general chemistry have been produced and evaluated in secondary school and college classrooms. The interactive tutorial lessons integrate computer graphics and text overlays with high quality video images of actual chemicals and their reactions. Most of the lessons consist of laboratory experiments which involve the students in hypothesizing, experimenting, collecting data, and analyzing data. The overlays help to focus students' attention on the interpretation of experimental results and encourage additional experimentation. Hardware used includes a Pioneer LD-V1000 laser video disc player controlled by an IBM personal computer using a Microkey overlay card produced by Video Associates Labs. The video images were recorded on a 3/4 inch videotape master, edited, then transferred to video disc.

CC-02 A NEW WAY TO TEACH HIGH SCHOOL CHEMISTRY LABORATORY. H. Saltsburg, R.H. Heist, and T. Olsen, Dept. of Chemical Engineering, Univ. of Rochester, Rochester, NY 14627.

Advancements in the high school chemistry laboratory have not kept pace with those in chemistry textbooks. As a result, it has become difficult to reinforce the quantitative aspects of chemistry stressed in the classroom with quantitative laboratory experiments. What is needed is a modern laboratory technology which does for laboratory studies what the word processor does for writers. CHEMPAC, a complete high school chemistry laboratory program, provides this approach. It is computer based (no simulations) and provides students with modern data acquisition and data logging capabilities. Each CHEMPAC workstation includes, among other items, a variety of sensors (temperature, pressure, pH and EMF), a colorimeter and complete software for the experiments. The laboratory manual is coordinated with the software. A detailed description of CHEMPAC, its capabilities and objectives will be given. Sample data from selected experiments will be illustrated and actual experiments will be demonstrated.

CC-03 THE SIMULATION OF LABORATORY EXPERIENCES, Joseph J. Lagowski, Department of Chemistry, The University of Texas at Austin, Austin, Texas 78712

For a number of years we have attempted to extend and expand the student's laboratory experience using computer-based simulation methods. We have adopted a simple strategy, designed to enhance student laboratory experiences, which incorporates the following principles: (1) Only individual simple laboratory operations are simulated; (2) There is no attempt to predetermine the sequence of operations for any given experiment. In other words, there is no right or wrong sequence; (3) we have developed a way to input data into an "operation module," allow the module to operate on the data, and then pass these data to the next module, what ever it may be; (4) Students are required to make detailed decisions concerning the choice of equipment, conditions under which the measurements are made, etc., much in the way they would do in a real laboratory; (5) Decisions are made from menus carefully designed to enhance the ease of the decision-making process; and (6) Extensive use of graphics and color also enhances the ease of decision-making. The results of using these simulated experiences with approximately 1000 students will be presented.

CC-04 THE COMPUTER-ASSISTED BLACKBOARD. Leonard J. Soltzberg, Department of Chemistry Simmons College, 300 The Fenway, Boston, MA 02115.

The Computer-Assisted Blackboard is an in-class lecture aid intended for use by the instructor rather than by the students. It serves as an adjunct to a conventional blackboard by allowing the lecturer to illustrate dynamic processes as opposed to static objects.

The software is not based on a script. Rather, it provides a collection of objects and processes which can be drawn, erased, and otherwise controlled to fit the presentation being made. Use of modular program design and compiled BASIC yields satisfactory speed for various animations.

Use of this technique will be demonstrated. In Computer Hands-On III Wednesday morning there will be an opportunity for hands-on experimentation by participants. See abstract #CH-22.

CC-05 CHEMISTRY LABORATORY REPORTS USING A SPREADSHEET COMPUTER PROGRAM. William Torop, Department of Chemistry, West Chester University, West Chester, PA. 19383.

The electronic spreadsheet, the computerized version of a laboratory notebook, adapts easily to the needs of both students and instructors. The advantages are in the extended calculation power and speed of the microcomputer, and the ability to save calculations and use them later with an integrated word processor. The software is "user-friendly", requiring minimal knowledge about computers or programming. Spreadsheet templates for all the freshman laboratory experiments requiring calculations at West Chester University will be demonstrated. The use of these spreadsheets permits students to check their data immediately and to detect and correct experimental errors while still in the laboratory. The use of these spreadsheets by the instructors requires less time than the traditional hand calculator method of checking student reports.

MONDAY, JULY 28, 1986

Opening Closed Doors

Strand Union Ballroom-C - Memorial Session in Honor of Edmund C. Fuller

10:00AM
Introduction
Session Chair, Gilmore K

10:05
MW-01
TEACHING CHEMISTRY TO MINORITY STUDENTS IN THE AIM PROGRAM
Doyle DJ, McAllister RM

10:20
MW-02
A MIDDLE SCHOOL SUMMER ENRICHMENT PROGRAM FOR MINORITY STUDENTS
Kean EM, Middlecamp C

10:35
MW-03
HEALTH CAREERS OPPORTUNITY PROGRAM- A PROGRAM TO ATTRACT MINORITY STUDENTS INTO HEALTH FIELDS
Pohlmann KO

10:50
MW-04
THE BRIDGE PROGRAM: PREPARING STUDENTS FROM THE INNER CITY FOR COLLEGE
Philipps DA, Philipps PK

11:05
MW-05
ETHNOGRAPHIC TECHNIQUES IN SCIENCE AND MATHEMATICS INSTRUCTION
Kanter MW

11:20
MW-06
MATH ANXIETY: WHY IS IT IMPORTANT IN CHEMISTRY AND WHAT ARE SOME THINGS I CAN DO ABOUT IT?
Carter CS, Yackel EB, Bodner GM

11:35
Discussion

MW-01 TEACHING CHEMISTRY TO MINORITY STUDENTS IN THE AIM PROGRAM. Daryl J. Doyle and Robert M. McAllister, Science and Mathematics Department, GMI Engineering & Management Institute, 1700 W. Third Avenue, Flint, Michigan 48502-2276.

During the school year of 1984, 30 high school minority students were invited to spend half a semester on the GMI campus as part of a program called AIM (Academically Interested Minorities). AIM was divided into chemistry, mathematics, computer programming, communications and study skills. These courses represent a typical freshman load.

For years, we have struggled using a traditional approach to teaching chemistry to minorities and searching for a better way. We wish to report on how a somewhat traditional approach can work when presented on campus before a minority student graduates from high school. The AIM program will be described in detail, and chemical topics covered will be emphasized. The results of how 18 AIM students performed academically as freshmen at GMI when compared to non-AIM minority students will be presented.

MW-02

A MIDDLE SCHOOL SUMMER ENRICHMENT PROGRAM FOR MINORITY STUDENTS. Elizabeth M. Kean and Catherine H. Middlecamp, Chemistry Tutorial Program, University of Wisconsin-Madison, Madison, WI 53706

This paper describes a summer enrichment chemistry program for minority middle school students. Students also participate in other science and math programs during an intense two week period. The purpose of the program is to encourage minority children to consider careers in the health sciences. Students enroll in the summer before 6th grade, and are invited back the following two summers for increasingly advanced work. Writing activities are a part of the chemistry lab experiences and become more important during the latter two years. A low teacher/student ratio allows the students to explore, explain, and rationalize phenomena. Examples of student work will be presented. Success of the program is measured by student questionaires, and by the percentage of students who reenroll during the three year sequence.

MW-03 HEALTH CAREERS OPPORTUNITY PROGRAM - A PROGRAM TO ATTRACT MINORITY STUDENTS INTO THE HEALTH FIELDS. Kenneth O. Pohlmann, Department of Chemistry, St. Mary's U., San Antonio, TX 78284.

The desire to attract more and better qualified minority students prompted St. Mary's U., The University of Texas Health Science Center-San Antonio, and the Kaplan Center to develop a program to enhance the student's study skills, reading and writing skills, research skills, and to provide a head start on some of the more difficult subjects required for their majors. The program is offered to incoming freshmen and continues in the Summers past their junior year. This paper will describe the program begun in 1984 and will give a description of the Chemistry component designed and presented in the Summer of 1985.

Title: The Bridge Program: Preparing Students from the Inner City for College

Authors: David A. Phillips, Wabash College, Crawfordsville, IN 47933
Prudence K. Phillips, Crawfordsville High School, Crawfordsville, IN 47933

Abstract:

MW-04 For the last five years, staff from Wabash College and from Crispus Attucks High School in Indianapolis have been working together to recruit and prepare students from this inner city high school for college. Not only do the students visit the Wabash Campus several times each school year, but they also spend two weeks at the College during the summers following their sophomore and junior years. In this presentation we shall describe the Bridge Program and discuss our experiences in developing and teaching a mini-course in chemistry last summer.

Presenter: David A. Phillips

MW-05

ETHNOGRAPHIC TECHNIQUES IN SCIENCE AND MATHEMATICS INSTRUCTION,

Muriel W. Kanter, Math/Sci/Tech Division, Roxbury Community College,
625 Huntington Avenue, Boston, Massachusetts 02115

Educational institutions in this country can no longer expect to enroll only "traditional" or "mainstream" students. Instead we find many students with varied cultural, ethnic, and linguistic backgrounds. Unfortunately such students frequently show patterns of high attrition and poor academic achievement.

A project at RCC, "Teaching from Strenghts," attempts to address this problem by utilizing some of the ethnographic techniques by suggested by Dr. Shirley Brice Heath and her colleagues. If we could understand how our students use language in their own cultures, perhaps we could use their strengths to help them reduce learning anxieties.

This talk will explain some of the particular ethnographic techniques that were tried and comment on the results.

MW-06

MATH ANXIETY: WHY IS IT IMPORTANT IN CHEMISTRY AND WHAT ARE SOME THINGS I CAN DO ABOUT IT?

Carolyn S. Carter, Erna B. Yackel, and George M. Bodner, Department of Chemistry, Purdue University, West Lafayette, Indiana 47907

Many students react to mathematics so strongly that their ability to solve problems, memorize, concentrate, pay attention or merely read any material containing numbers, charts, graphs or equations is greatly restricted. Distinct from lack of mathematical knowledge or skills, math anxiety is fairly widespread among college students. Affecting the academically able as well as poor students, math anxiety has a debilitating effect on many of the skills important for success in general chemistry. Students who rely on memorized solutions or algorithms as the basis of their chemical problem-solving strategies are affected because anxiety interferes with memory. Anxiety also interferes with the ability to make decisions or generate alternative solutions when solving problems. Increasing mathematical knowledge does not relieve math anxiety; decreasing anxiety is a prerequisite to improving mathematical knowledge and problem-solving skills. Decreasing anxiety seems to require changes in problem-solving strategies and in beliefs about the role of memory and ability in mathematics and chemistry. A problem-solving approach to general chemistry is recommended for the success of math-anxious students.

MONDAY, JULY 28, 1986
Chemistry for Kids I
Strand Union Ballroom - D

10:00AM
Introduction
Session Chair, **Diem MJ**

10:05
KC-01
IMPROVING THE QUALITY AND QUANTITY OF CHEMISTRY EDUCATION AT PRE-HIGH SCHOOL LEVELS. IS THE BEAKER HALF EMPTY OR HALF FULLL? ONE EDUCATOR'S PERSPECTIVE.
Barhydt FB

10:55
KC-02
AN INTRODUCTORY, HANDS-ON CHEMISTRY UNIT FOR INCORPORATION IN ELEMENTARY CURRICULA
Diem MJ

11:45
Discussion

KC-01 IMPROVING THE QUALITY AND QUANTITY OF CHEMISTRY EDUCATION AT PRE-HIGH SCHOOL LEVELS. IS THE BEAKER HALF EMPTY OR HALF FULL? ONE EDUCATOR'S PERSPECTIVE. Frances B. Barhydt, 1504 N. Broom Street, Bldg. 2, Unit 18, Wilmington, Delaware 19806

Since the American Chemical Society has identified as one of its goals the improvement of the quality and quantity of physical sciences in the pre-high school levels, you may find yourself on an educational committee, in an elementary classroom, or writing chemistry concepts for curriculum guides or articles. This talk will introduce the three significant curriculum developments that have influenced science education since the 1960's and explain the problems that have kept them from their rightful place in our classrooms. It will include strategies to be considered by ACS as an organization and by individual members leading to the improvement of science education. Slides of elementary students engaged in basic lab skills will be shown.

KC-02 AN INTRODUCTORY, HANDS-ON CHEMISTRY UNIT FOR INCORPORATION IN ELEMENTARY SCIENCE CURRICULA

An introductory chemistry unit has been developed and utilized in elementary classrooms throughout New York State. The program package includes teacher training, teacher manual (incorporating objectives, vocabulary, materials, activity description, discussion questions and background information), hands-on materials for thirty students, worksheets, suggestions for integration into other subject areas, and STS culminating activities.

Activities are designed to develop the process skills, improve problem solving ability and improve science attitudes. Content areas focus on the atom, elements, physical changes, chemical changes, types of reactions and acids and bases.

Concluding remarks will deal with success of this program, materials management of hands-on materials, and teacher training.

MONDAY, JULY 28, 1986
Writing Across the Curriculum
Strand Union Ballroom - B

10:00AM
Introduction
Session Chair, **Neidig HA**

10:05
RT-01
LEARNING CHEMISTRY THROUGH WRITING
Neidig HA, Markowicz LE

10:30
RT-02
WRITING ACROSS THE CHEMISTRY CURRICULUM
Orna MV, Sisco R, Egan M

10:55
RT-03
TECHNICAL WRITING-AN INDUSTRIAL PERSPECTIVE
Landesberg MK

11:20
RT-04
TEACHING LABORATORY NOTEKEEPING FROM AN INDUSTRIAL PERSPECTIVE
Kanare HM

RT-05
COMMUNICATIONS: KEY TO MAKING THE "BETTER MOUSETRAP" SAYING COME TRUE
McClelland AL

11:45
Discussion

RT-01

LEARNING CHEMISTRY THROUGH WRITING, H. A. Neidig and L. E. Markowicz, Lebanon Valley College, Annville, PA 17003

A first-year chemistry honors course was team taught by a member of the English department (LEM) and a member of the Chemistry department (HAN). Extensive use was made of free writing, specific writing assignments, laboratory notebook and chemistry journal entries, and laboratory reports.

In this presentation, examples will be given to suggest how students in a first-year chemistry course can gain additional insight into chemistry through writing.

RT-02 "WRITING ACROSS THE CHEMISTRY CURRICULUM," Mary Virginia Orna, Rosemary Sisco and Marie Egan, Department of Chemistry, College of New Rochelle, New Rochelle, NY 10801; (914) 632-5300, ext. 302.

There is a growing interest on the part of chemistry teachers to teach writing skills within the chemistry curriculum. This paper will outline how this is done on the introductory level by emphasis on organization of the laboratory notebook, instruction on writing a laboratory report from the collected data, constructive criticism of submitted work, acceptance of one or more drafts before the final product and immediate feedback with respect to these drafts through interaction with peer tutors. By interfacing laboratory report writing with a concurrent writing course in which word processing is taught, changes based on the intermediate feedback can quickly be made and thus reduce the chore of preparing the final draft. Advantages and disadvantages of this approach will also be discussed.

RT-03 TECHNICAL WRITING-AN INDUSTRIAL PERSPECTIVE, M. K. Landsberg, Exxon Research & Engineering, P.O. Box 101, Florham Park, NJ 07932

The importance of written communication in industry (as well as academia) cannot be overestimated: work not documented--in technical reports, correspondence, patent memoranda, lab notebooks, manuals, analytical methods, scholarly papers--is, quite simply, work not done! Furthermore, work whose documentation is not understandable or whose practical applications or potential are not specifically and clearly identified is of little consequence to an organization. My paper will deal with the various types and purposes of documentation used in industry. It will stress the importance of authors' knowing the varying audiences for their writing and understanding the purposes and special requirements of each type of document they write.

RT-04 TEACHING LABORATORY NOTEKEEPING FROM AN INDUSTRIAL PERSPECTIVE. Howard M. Kanare, Portland Cement Association, 5420 Old Orchard Road, Skokie, IL 60077-4321.

Industrial scientists write many hundreds of pages of notes during their careers. These notes can be crucial in patent disputes and often can make or break a research project depending on their completeness and clarity. The principles of good notekeeping have never been specified by granting institutions or codified by professional societies. We now have the opportunity to teach the methods of proper notekeeping in a unifrom, consistent manner to all students. In addition to their obvious potential monetary value, good notes can help the researcher to work more effectively, reducing wasted time and effort. The attitude toward notekeeping reflects the young scientist's attitude and approach to solving scientific problems in general and thus is an indicator of maturity and ability to reason clearly.

RT-05 COMMUNICATIONS: KEY TO MAKING THE "BETTER MOUSETRAP" SAYING COME TRUE. A. L. McClelland, Central R&D Dept., Du Pont Co., Wilmington, DE 19898

The world does not necessarily beat a path to the domicile of that "better mousetrap"-- nor to the "better chemist" who is looking for a job. Communications skills--oral and written--are crucial throughout our careers. In industry, that is true from the time one first seeks a job to the day of retirement. We'll look at examples, good and bad, discuss their virtues and failings, and define the requirements for good communication in various circumstances. There are skills students should be working on throughout school---and often ones they'll never learn from the English Department. What can chemistry profs do to help? What can and should we in industry do? The emphasis will be on practical, time-saving techniques suitable for everyone.

MONDAY, JULY 28, 1986
Teaching Organic Chemistry I
234 Gaines Hall

10:00AM
Introduction
Session Chair, **Engle T**

10:05
OR-01
THE ELEMENTS OF QUAL ORGANIC AS A FIRST SEMESTER ORGANIC LAB COURSE
Franzen GR

10:25
OR-02
COMPUTERIZED DATABASE SEARCHING IN SOPHOMORE ORGANIC CHEMISTRY
Henderson JW

10:45
OR-03
A PROJECT IN TECHNIQUE AND SYNTHESIS FOR THE ADVANCED ORGANIC CHEMISTRY LABORATORY
Howell BA

11:05
OR-04
HYDROBORATION-OXIDATION IN THE BEGINNING ORGANIC CHEMISTRY LABORATORY
Howell BA, **Sennett MB**
OrG

11:25
OR-05
CONSERVATION OF SYMMETRY IN STEREOSPECIFIC CHEMICAL REACTIONS
Lee AWM

OR-01 THE ELEMENTS OF QUAL ORGANIC AS A FIRST SEMESTER ORGANIC LAB COURSE

Gerald R. Franzen, Chemistry Department, Thomas More College,
Crestview Hills, KY 41017

The first semester of the Organic Laboratory sequence at Thomas More College is devoted to the elements of the traditional Qual Organic course, modified to include IR and NMR spectroscopy. Two known compounds, eugenol and cholesterol, are isolated at the outset and investigated throughout the semester. The determination of physical properties and IR and NMR spectra, functional group analysis (wet tests) and derivative preparation are illustrated with the knowns. Each student is given a simple liquid unknown for similar investigation and final identification. Progress reports on the knowns and a final report on the identification of the unknown are required. This course provides an introduction to a wide range of functional groups and some of their properties. It also gives the student experience in techniques which are used for isolation, purification and characterization in the syntheses done in the second semester Organic Laboratory course.

OR-02 COMPUTERIZED DATABASE SEARCHING IN SOPHOMORE ORGANIC CHEMISTRY. John W. Henderson, Jackson Community College, Jackson, MI 49201

Of the students now taking sophomore organic chemistry laboratory, most will go through their entire careers without ever again running a Grignard reaction, but there will be very few who will not use computerized database searching. Over the past two years I have introduced laboratory assignments involving the use of the online versions of Chemical Abstracts and American Chemical Society Journals. I will discuss the successes and failures of different types of questions, strengths and weaknesses of the BRS/After Dark database service we use, student response to the assignments and integration of online database searching into literature assignments, use of microcomputer databases and writing assignments throughout our two year transfer chemistry program.

OR-03 A PROJECT IN TECHNIQUE AND SYNTHESIS FOR THE ADVANCED ORGANIC CHEMISTRY LABORATORY. B. A. Howell, Department of Chemistry, Central Michigan University, Mt. Pleasant, MI 48859

The synthesis and subsequent hydrogenolysis of methyl(p-substitutedphenyl)cyclobutylcarbinols have been utilized to provide exposure to most of the techniques common to modern organic chemistry for students in an advanced laboratory course. The systhesis is based on diethyl malonate and 1-bromo-3-chloropropane as ultimate starting materials and proceeds via cyclobutane carboxylic acid and cyclobutyl methyl ketone as prominent intermediates. A variety of reagents and techniques [active metals, organometallics, alkylation of enolates, saponification, pyrolysis, distillation (bulb-to-bulb, short path, Claisen still, spinning-band), crystallization, chromatography (tlc, hplc, glpc, flash), inert atmosphere procedures] are utilized for the preparation of the carbinols. All isolated materials are characterized using spectroscopic techniques [ir, nmr (^{1}H and ^{13}C), ms]. The kinetics of the hydrogenolysis reaction is examined by competition methods. The relative rate constants are utilized for the construction of a Hammett plot from which implications for the reaction mechanism may be derived.

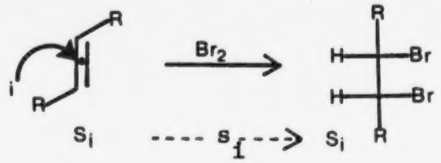
OR-04 HYDROBORATION-OXIDATION IN THE BEGINNING ORGANIC CHEMISTRY LABORATORY. B. A. Howell and M. B. Sennett, Department of Chemistry, Central Michigan University, Mt. Pleasant, MI 48859.

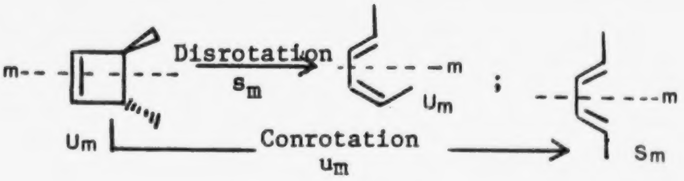
Most modern organic chemistry textbooks present hydroboration-oxidation and oxymercuration-demercuration as regioselective methods (and methods of choice) for the conversion of alkenes to alcohols. In contrast, these reactions, though prominent and useful procedures, are not included in manuals designed to be used in the laboratory portion of the beginning course in organic chemistry. To overcome this deficiency, we have developed a hydroboration-oxidation experiment suitable for use in the laboratory course. Hydroboration of 3,3-dimethyl-1-butene with commercially available borane-methyl sulfide complex followed by oxidation with alkaline aqueous hydrogen peroxide affords 3,3-dimethyl-1-butanol which can be readily purified by distillation at atmospheric pressure. All manipulations can be carried-out in simple glassware common to the first laboratory course in organic chemistry.

OR-05 CONSERVATION OF SYMMETRY IN STEREOSPECIFIC CHEMICAL REACTIONS.

Albert W.M. Lee, Department of Chemistry, Hong Kong Baptist College, 224 Waterloo Road, Hong Kong.

In a stereospecific reaction, the reactant and the product molecules are classified either as Symmetrical(S) or Unsymmetrical(U) with respect to a specified symmetry element (a mirror plane(m), a center of inversion (i), or a C_2-axis). Similarly, the reaction mechanism (operation) can be either symmetrical(s) or unsymmetrical(u) as well. These symmetry properties of the reactant, product and operation are conserved. Namely, a symmetrical reactant will yield a symmetrical or unsymmetrical product after an overall symmetrical or unsymmetrical operation respectively. This principle of conservation of symmetry will be validated through the examination of various concerted and non-concerted processes such as addition, elimination, cycloaddition, electrocyclic and sigmatropic reactions.





MONDAY, JULY 28, 1986
Teaching Assistants I
275 Student Union Building

10:00AM
Introduction
Session Chair, **Kastner M**

10:45
TA-01
A PREVIEW OF TA TRAINING AT UCLA
Russell AA

10:25
TA-02
TRAINING AND USING TEACHING ASSISTANTS IN A LARGE FRESHMAN CHEMISTRY PROGRAM
Zumdahl SS

10:05
TA-03
STRATEGIES FOR THE DELEGATION OF TEACHING TO TEACHING ASSISTANTS IN LARGE MULTISECTION COURSES
Jones LL

11:05
TA-04
THE TRAINING AND SUPERVISION OF TEACHING ASSISTANTS AT THE UNIVERSITY OF DELAWARE
Burmeister JL

11:25
TA-05
INPUT-OUTPUT: PREPARING TEACHING ASSISTANTS FOR AN UNDERGRADUATE INSTRUMENTATION LABORATORY
Magnuson DT

11:45
Discussion

TA-01 A PREVIEW OF TA TRAINING AT UCLA. A.A. Russell, 1037 Young Hall, Department of Chemistry and Biochemistry, Los Angeles, CA 90024

Undergraduate students expect Teaching Assistants to know more than Chemistry. They expect their TA's to know Department facilities and policies as well as effective teaching methods. The UCLA Chemistry and Biochemistry Department attempts to meet these needs in an intensive, TA-training program just before the Fall term. A videotape synopsis of the week-long program serves as an abstract to the program. This preview assuages the new graduate students' apprehensions and ensures them there will be adequate time to address their questions and concerns. With an understanding of the structure of their training the new TA's concentrate on each aspect of the program as it follows the outline of the videotape. The undergraduate advisor describes the undergraduate program; experienced TA's conduct a tour of the Department's nooks and crannies; two days are devoted to viewing and discussing Project Teach materials; the safety chairman leads a seminar on safety; TA consultants conduct microteaching sessions; and finally, course instructors hold the first of their weekly, course-specific TA meetings.

TRAINING AND USING TEACHING ASSISTANTS IN A LARGE FRESHMAN CHEMISTRY PROGRAM, S.S. Zumdahl.

TA-02 The general chemistry program at the University of Illinois depends more heavily on teaching assistants than most introductory programs. Thus the selection and training of the TAs is especially important. The training program features three days of intensive orientation that involves the use of six senior TAs as mentors. This program provides information and emphasizes attitudes that promote effective teaching. Each TA mentor assumes responsibility for a group of 15-20 new TAs and runs sessions that focus on effective teaching. One session centers around a videotape of several successful TAs with very different styles as they teach quiz sections. At the conclusion of the orientation program each new TA presents part of a lesson to his/her group. Another essential aspect of our TA training involves observation of each TA in the classroom during the semester; and some TAs are videotaped using a portable camera. The use of undergraduates as TAs also will be discussed.

TA-03 STRATEGIES FOR THE DELEGATION OF TEACHING TO TEACHING ASSISTANTS IN LARGE MULTISECTION COURSES. Loretta L. Jones, School of Chemical Sciences, University of Illinois, 601 S. Mathews St., Urbana, IL 61801

Three of the large introductory chemistry courses (600-2000 students) at the University of Illinois are taught by teaching assistants with the use of videotaped lecture materials. In addition to a three hour lab session, each 25 student section meets four times a week with a teaching assistant. The teaching assistant controls the playback of two to four short, documentary style videotapes each week and administers a quiz. Classroom aids provided include demonstration materials and a comprehensive course syllabus containing lecture notes, videotape summaries, and daily assignments. Teaching assistants are aided in their preparation by a daily lecture outline with sample problems prepared by the course director. Strategies used to prepare inexperienced teaching assistants for this type of course will be discussed and training materials will be demonstrated.

TA-04 THE TRAINING AND SUPERVISION OF TEACHING ASSISTANTS AT THE UNIVERSITY OF DELAWARE. John L. Burmeister, Department of Chemistry, University of Delaware, Newark, DE 19716

The TA training program at the U of D focuses on the areas of subject matter competency, pedagogic skills, safety practices and, for TA's who do not use English as their native language, communications skills. All new TA's participate in a five day departmental workshop and a two day university-wide workshop immediately prior to the beginning of the fall term. The former involves proficiency exams in analytical, inorganic, organic, and physical chemistry and biochemistry (which, along with student-specified areas of interest, determine TA placement in courses), department-specific TA tips, and safety indoctrination. The latter deals with a broad spectrum of pedagogic skills, including presentations from faculty and experienced TA's, grading tips, an overview of the problems confronting foreign TA's in American universities, tips on leading discussions, asking and answering student questions, developing test items, dealing with academic dishonesty, conducting review and problem sessions for technical courses, organizing and running science laboratories, using media effectively, using demonstrations as a technique for teaching concepts and principles, and building a supportive classroom environment for women and black students. In addition, a stipend-supported university-wide three week foreign teaching assistant training program is held during the month of August to provide new graduate foreign teaching assistants with language enhancement and cultural/pedagogical orientation to the American university.

TA-05

INPUT-OUTPUT: PREPARING TEACHING ASSISTANTS FOR AN UNDERGRADUATE INSTRUMENTATION LABORATORY

D.T. Magnuson, Department of Chemistry, Texas A&M
University, College Station, Texas 77843.

Strategies will be presented for developing a successful team of teaching assistants for an undergraduate instrumentation laboratory. Topics covered will include: choosing the teaching assistants and planning the orientation meeting, using the team work approach to laboratory preparation tasks, preparing the T.A. for his first meeting with his class, emphasizing the art of teaching, helping the T.A. improve his instrumentation skills, planning and organizing the laboratory work, effective grading techniques, and the importance of recognizing good teaching efforts.

Monday, July 28, 1986
Demonstrations by Demonstration I
101 Gaines Hall

10:00AM
Introduction
Session Chair, **Rand R**

10:05
DE-01
TLC IN THE CLASSROOM
Rand R, Lerch A

10:25
DE-02
THEMATIC DEMONSTRATION SHOW: ESTER, WHAT'S IN MY FOOD
Epp DN, Wuerthele JA, Clarke M, Gallup M, Wilson JR, Brown A

10:45
DE-03
USING BROMOCRESOL GREEN TO DEMONSTRATE THE ACETATE BUFFER SYSTEM
Shaw DB

11:05
DE-04
HIGH SCHOOL CHEMISTRY TEACHERS ARE MORE THAN ALCHEMISTS!
Gromko M

11:25
DE-05
MOLES OR DOZENS? IT STILL COUNTS
Bergquist W

11:45
DE-06
IT'S ALL IN HOW YOU TEACH IT!
Burnett, DW

Moved to Dreyfus presents Monday afternoon

DE-01

TLC IN THE CLASSROOM.

Ruth Rand and Annabelle Lerch. The Latin School of Chicago, Chicago, Ill,60610 and Pocatello High School, Pocatello, Idaho,83201

The theory and practice of partition chromatography will be discussed. Various applications of this technique in pharmaceutical research will be presented. Suggestions wil be presented for using chromatography in the classroom to enhance studies in chemistry, biochemistry, biology, nutrition. Proceedures to identify metabolic products of steroids and proteins will be explained. Those attending this session will have the opportunity to work with commercially available thin layer chromatography kits.

DE-02 THEMATIC DEMONSTRATION SHOW: ESTER, WHAT'S IN MY FOOD Dianne N. Epp, East H.S., Lincoln, NE. 68510, Judith A. Wuerthele, Ellington H.S., Ellington, CT 06029, Ann Brown, Sun Prairie Jr/Sr H.S., Sun Prairie, WI 53590, Mary Gallup, South Beloit H.S, South Beloit, Il 61080, Michele Clarke, Marquette H.S., Milwaukee, WI 53208, Jeffrey R. Wilson, E.G. Kromrey Middle School, Middleton, WI 53562

In order to attract the attention of students to a particular chemical concept, a thematic demo show may prove an effective tool. The following was organized for 5th and 6th graders but could easily be geared to Jr or Sr High students. A demo show works well not only for a single class but also for a larger group as the joint effort of several teachers. To be effective it should include: an organizational idea, a variety of demos, student participation, a 30 - 40 min. time limit and a follow-up activity.

Ester, What's in my food or Odor + Taste = Flavor. The organizational idea for this show is that the sensation of flavor which we experience often results from a combination of both odor and taste. The underlying chemical concept is the relation of natural and synthetic odors to the chemical family of esters.

DE-03

Using Bromocresol green to Demonstrate the Acetate Buffer System

David B. Shaw, Institute for Chemical Education, University of Wisconsin--Madison, Madison, WI 53706.

The understanding of acid-base buffers is one of our most important yet complex topics. While a pH meter can provide numerical values for the pH of different solutions, they are expensive to purchase and difficult to maintain. Using acid-base indicators allows easy visualization of the pH, even for a large class, and is much more cost efficient. The buffering capabilities of sodium acetate/acetic acid can be illustrated for an entire class using bromocresol green indicator, common solutes, and a collection of beakers. This will be presented in the form of a classroom lecture demonstration.

DE-04

HIGH SCHOOL CHEMISTRY TEACHERS ARE MORE THAN ALCHEMISTS!

Mary Gromko Rampart High School 8250 Lexington Drive
Colorado Springs Colorado 80918

In order to live in a future world of change, all students need an understanding of the nature of science: how it works and what it can and can not do. The learning of science should be viewed as an integral component of life experiences and not as an isolated subject or topic. Demonstration material from past Dreyfus programs will be presented which can be used to emphasize that chemistry is a problem solving activity which requires the use of critical thinking and decision making skills. Students must be taught these skills to improve their own lives and to deal responsibly with societal issues. As an example, the study of buffers from Dreyfus '83' can be a lead in to the demonstration of the Dreyfus '83' Do Lakes Need Bufferin?. The theory of buffers can lead to the acid rain topic. We must educate our students to appreciate the value of chemistry in our society but also to understand its limitations.

DE-05

MOLES OR DOZENS? IT STILL COUNTS by Wilbur Bergquist

The concept of the mole is both one of the most important and more troublesome one for beginning chemistry students to master. When I introduce the mole I try to make use of the students grasp that dozens of objects is the same amount, regaurdless of the item being counted. More importantly I stress that the mole is also related to the mass ot items, In this case atoms or molecules, being counted. In stressing this fact I have made up two sets of special eggs, identical mass eggs. Using these eggs we explore the relation between the mass and the number of items we can count.

DE-06

IT'S ALL IN HOW YOU TEACH IT! Practical Approaches to Abstract Concepts.

Burnett, Diane Wilson. Warren Central High School, 9500 East 16th Street,
Indianapolis, IN 46229

The concepts of density, percent composition, moles, stoichiometry or isotopes are among the abstract concepts which are not enthusiastically received by most high school students. However, an activity/demonstration approach will increase the interest level and understanding of your students.

Monday, July 28, 1986
Quantitative Lecture-Hall Experiments
101 Gaines Hall

1:00PM
Introduction
Session Chair, **Hutton W**

DQ-01
COMBINING VOLUMES, STIOCHIOMETRY, AND THE REACTION OF NO AND O2.
Schwartz AT

DQ-02
QUANTITATIVE CHEMICAL DEMONSTRATIONS
Ramette RW

DQ-03
THE HYDROLYSIS OF t-BUTYL CHLORIDE
Bell JA, Lamb W

DQ-04
TEACHING THE CONCEPTS OF ACCU. AND PREC. AS YOU INTRODUCE YOUR COMPUT.
Shaw DB

DQ-05
GAY-LUSSAC'S LAW OF COMBINING VOLUMES
Perkins RI

DQ-06
A THERMODYNAMICS STUDY
Koubek E

DQ-01 COMBINING VOLUMES, STOICHIOMETRY, AND THE REACTION OF NO AND O_2. A. Truman Schwartz, Department of Chemistry, Macalester College, St. Paul, MN 55105.

This quantitative lecture demonstration is based upon Joseph Priestley's test for the "goodness of air." Measured volumes of gaseous nitrogen oxide and oxygen are mixed and allowed to react over water. The reddish-brown fumes of nitrogen dioxide dissolve in the water, and the volume of the residual gas decreases dramatically. This residual volume is measured, and the results can be used to demonstrate the stoichiometry of the reaction, the concept of limiting reagent, the law of combining volumes, and the percent of oxygen in the atmosphere.

DQ-02 QUANTITATIVE CHEMICAL DEMONSTRATIONS
R. W. Ramette, Carleton College, Northfield, MN 55057

Some examples of demonstrations that yield useful quantitative data will be discussed. (a) From simple weighing of a gas in a bulb, at known T and P, a good value for the ideal gas constant. (b) Determination of KI in "iodized" salt by titration. (c) From measured redox stoichiometry, the oxidation state of an element in an unknown product. (d) From thermal decomposition and weighing, the formula for HgO. (e) From direct synthesis, the formula for CuI. (f) Determination of vitamin C in a tablet by iodine titration. (g) Preparation of a buffer and determination of pK. (h) Acid-base stoichiometry and standardization. (i) From freezing point depression and mass spectroscopy, different values for the molecular weight of acetic acid.

DQ-03 THE HYDROLYSIS OF t-BUTYL CHLORIDE: A CLASSROOM EXPERIMENT. Jerry A. Bell, National Science Foundation (on leave from Simmons College, Boston, MA 02115), and William Lamb, Oregon Episcopal School, Portland, OR 97223.

This experiment is an adaptation for lecture/classroom use of the t-butyl chloride hydrolysis clock reaction system (J. A. Landgrebe, J. Chem. Educ. 41: 567 (1964)). Hydrolysis produces hydronium ions that react with a small, known amount of hydroxide ion added initially to the system. An acid/base indicator color change signals the consumption of the hydroxide ion and, hence, the "ringing" of the alarm clock (J. T. Riley, J. Chem. Educ. 54: 29 (1977)). Several different variations of the concentrations, solvent composition, added ions (W. C. Danen and M. T. Blecha, J. Chem. Educ. 59: 659 (1982)), etc., are carried out on this system simultaneously by the class, using previously prepared sets of reagents handed out during the lecture, and the combined data analyzed Socratically. If facilities permit, we will introduce a computer spreadsheet program to aid the analysis.

DQ-04 **TEACHING THE CONCEPTS OF ACCURACY AND PRECISION AS YOU INTRODUCE YOUR COMPUTERS.** David B. Shaw, Madison Area Technical College, 3550 Anderson Street, Madison, WI 53704.

Students are shown a slide of a familiar measuring device, and are asked to record the value displayed, using the available computer. After instructions are given for logging onto the computer system, the measurement is recorded by each person in the class. The data is then summarized and shown in the form of a bar graph or histogram. The follow-up discussion is used to reinforce the differences between accuracy and precision, as well as to smooth the way for future uses of the computer.

DQ-05 GAY-LUSSAC'S LAW OF COMBINING VOLUMES. R. I. Perkins, Institute for Chemical Education, Department of Chemistry, University of Wisconsin, Madison, Wisconsin 53706

Using a nitrogen (II) oxide/oxygen system, one can demonstrate this gas law quantitatively in a very visible way without the chance of venting poisonous gases into the room.

DQ-06 A THERMODYNAMICS STUDY. E. Koubek, U.S. Naval Academy, Annapolis, MD

This experiment illustrates how one can obtain the thermodynamic properties of a substance. By following the equilibrium pressure of NH_3 and CO_2 at different temperatures, students can calculate ΔG°_T, ΔH, ΔS, ΔE for the reaction

$$NH_4CO_2NH_{2(s)} \rightarrow 2NH_{3(g)} + CO_{2(g)}$$

From these, values of ΔG°_f, ΔH°_f and ΔS°_{298} for $NH_4CO_2NH_{2(s)}$ may be determined.

The apparatus that will be demonstrated is of the authors own design. The audience will be encouraged to collect their own data. A discussion of the results obtained will be presented on the last day of the symposium.

Monday, July 28, 1986
Issues on Grading/Teaching Freshman Chemistry
Strand Union Ballroom - C

2:45PM
Introduction
Session Chair, **Perry WD**

2:50
GR-01
HIDDEN ASPECTS OF GRADING SCHEMES - SELF WORTH AND SCIENCE ANXIETY
Whyte HM

3:10
GR-02
MEASURING STUDENT KNOWLEGE VS RANKING STUDENTS: WHAT DO GRADES DO?
Kean EM, Middlecamp CH

3:30
GR-03
GRADING FOR RESULTS
Kerner NK

3:50
Discussion

Intermission

4:20
GR-04
ESTABLISHING PREDICTORS OF SUCCESS
Bauman JE, Henry RK

4:40
GR-05
PREDICTABILITY OF COLLEGE CHEMISTRY GRADES BASED ON HIGH SCHOOL VARIABLES
Tanaka J, Taigen J

5:00
GR-06
STUDENT ATTRIBUTES AND GRADES IN FRESHMEN CHEMISTRY
Bishop CB, Bishop MB

5:20

GR-01 HIDDEN ASPECTS OF GRADING SCHEMES - SELF WORTH AND SCIENCE ANXIETY.

Helena M. Whyte, PA-15, Los Alamos National Laboratory, Los Alamos, NM 87545

Education is about helping students to win. It's not about criticizing, reprimanding, or looking for flaws; it's not about making the instructor look good by giving a certain percentage of bad marks. Grading schemes say that some students are better than others. The losers trying to protect their dignity and pride quit and leave with a low self-image and hatred of all things mathematical and scientific. At Los Alamos National Laboratory we train technicians in math and scientific skills. We do not grade students; we certify that they have the skills to do their jobs. In a class where students are doing (not getting ready for some distant future) what they do tells us what they've learned. The students leave us with an improved self-image and a new zest for life-long learning. School dropouts yearn to take classes again and many pursue degree work. What makes their experience positive in the Laboratory setting and negative in a more traditional setting?

GR-02 MEASURING STUDENT KNOWLEDGE VS RANKING STUDENTS: WHAT DO GRADES DO?

Elizabeth M. Kean and Catherine H. Middlecamp, Chemistry Tutorial Program, University of Wisconsin-Madison, Madison WI 53706

Two important goals of chemistry courses are 1) student learning, and 2) ranking of students in order of text grades. Current testing/grading practices are more successful at ranking students than measuring learning. We will use student interview and test data to illustrate how the ability to answer typical chemistry test questions may indeed be unrelated to students' chemical knowledge.

Test-makers are also under pressure to conform to tacit norms with respect to an appropriate exam mean, distribution of grades around the mean, and expectations about numbers of unsuccessful students. Faculty often use "differentiating" questions to distribute scores, questions which require students to use information in novel ways. Skills for such use of information are rarely part of the chemistry curriculum, leading to student rankings which are based on untaught material.

The paper will close with suggestions for how to relate questions more directly to teaching and learning within chemistry courses.

GR-03 GRADING FOR RESULTS

Nancy Konigsberg Kerner, Department of Chemistry, The University of Michigan, Ann Arbor, Mich. 48109

In order to encourage scientific inquiry in the lab we must have a grading scheme that gives credit for student results derived from data obtained in the lab. Giving credit for "correct answers" that do not follow from experimental data or expecting answers that are beyond a student's knowledge will reinforce erroneous student attitudes. In particular, expecting answers that are beyond the student's experience will lead him/her to believe that he/she is supposed to know skills, concepts, or results before he/she enters the lab. The grading scheme we have evolved at The University of Michigan is designed to avoid these pitfalls and to reward student results and correct inferences obtained from actual lab experience. Thus, the grading scheme encourages the development of scientific inquiry.

GR-04 ESTABLISHING PREDICTORS OF SUCCESS. J. E. Bauman and R. K. Henry, Department of Chemistry, University of Missouri, Columbia, MO 65211.

Statistics were gathered on a large, first-semester, general chemistry class for science majors at the University of Missouri. Several models were studied as follows:

Model 1. Correlation between final course grade and score on Missouri Math Placement Test or ACT.

Model 2. Prediction of final grade based on completion of math and science credits in high school. Allowance may be made for school classification and regional area.

Model 3. Correlation of first exam score with eventual total points in the course.

The study shows that predictors can be established using minimal academic information prior to student admittance into the course. Also students may be redirected after the first course evaluation if poor performance is shown. The three models allow post-secondary advisors and instructors to predict student success prior to and after student admittance to the course.

GR-05 PREDICTABILITY OF COLLEGE CHEMISTRY GRADES BASED ON HIGH SCHOOL VARIABLES. John Tanaka and Janith Taigen, Honors Programs and Department of Chemistry, University of Connecticut, Storrs, Connecticut 06268.

Correlation studies were carried out to determine whether the college chemistry GPA for Honors Scholars correlated with a variety of high school parameters. These parameters were: number of high school chemistry courses taken, number of high school physics courses taken, the number of calculus courses taken in high school, the high school chemistry grade, the high school physics grade, the high school calculus grade, the high school class rank, the SAT verbal, the SAT math, and the size of the high school. On the basis of the R-squared values, there was no predictability for college chemistry performance with any of these variables. Even when combinations of the variables were taken, no predictive tool became apparent. The tenative conclusion is that, for the honors students studied, non-cognitive factors outweigh the cognitive variables which are usually available for evaluative purposes.

GR-06 STUDENT ATTRIBUTES AND GRADES IN FRESHMEN CHEMISTRY. Carl B. Bishop and Muriel B. Bishop, Department of Chemistry, Clemson University, Clemson, SC 29634-1905.

Concern over the differences in grades on different scrambled forms of the same exam given simultaneously to all sections of freshmen chemistry prompted a study of the correlation of student attributes to their grades in freshmen chemistry. The attributes that were studied were SAT scores in mathematics, mathematics course presently taking, and major.

Discussion
Monday, July 28, 1986
History of Chemistry
Strand Union Ballroom - B

2:45PM
Introduction
Session Chair, **Davenport DA**

2:50
HS-01
JEAN-BAPTISTE DUMAS: THE VICTOR HUGO OF CHEMISTRY
Chastain BB

3:10
HS-02
HISTORY OF CHEMISTRY: 30-MINUTES VIDEOS FOR EDUCATIONAL TV CHANNEL
Suter PH

3:30
HS-03
JOSEPH PRIESTLEY
Kastner ME, Blatchley R

3:50
HS-04
HISTORY OF CHEMISTRY-HISTORY OF SCIENCE: A STUDY TOUR
Grindstaff CS, **Grindstaff WK**

4:10
HS-05
AN UPDATE OF THE HISTORY OF CHEMISTRY TOURS
Wotiz JH

4:30
HS-06
KEKULE AND THE RULES OF EVIDENCE IN HISTORY OF CHEMISTRY
Wotiz JH, Rudofsky S

4:50
HS-07
DEVELOPMENT OF THE MODERN PERIODIC TABLE
Gerlach DL

Moved to Dreyfus presents Monday afternoon

5:10
HS-08
LIEBIG AND LAVOISIER
Crabtree AL

HS-01 JEAN-BAPTISTE DUMAS: THE VICTOR HUGO OF CHEMISTRY. Ben B. Chastain, Chemistry Department, Samford University, Birmingham, AL 35229.

Especially in courses for non-majors, the history of chemistry can be used to remind students that science is done in the context of a specific society or culture and that scientists are human beings whose attitudes are affected by religion, art, and politics.

For example, the great Romantic movement which swept through art, music, and literature between the late 18th and late 19th centuries also left its mark on the science of the period.

The preeminent French chemist of the time was Jean-Baptiste Dumas (1800-1884). His contributions to the development of chemistry will be discussed, and parallels drawn to the life, work, and influence of his fellow countryman Victor Hugo (1802-1885).

HS-02

HISTORY OF CHEMISTRY: 30-MINUTES VIDEOS FOR EDUCATIONAL TV CHANNEL. Patricia H. Suter, Department of Chemistry, Del Mar College, Corpus Christi, TX 78404

Del Mar College recently obtained a TV channel on the cable network which supplies the area. The college offers courses for credit. A number of programs are also being offered for educational-entertainment purposes. The series of 30-minute videos on the history of chemistry fall into this category. To date five programs have aired covering the time period to 1850. These programs have had many favorable comments from the public and we here at Del Mar College believe they serve to draw positive attention to chemistry and to the college. This paper will discuss the preparation and the content of the programs.

HS-03 JOSEPH PRIESTLEY, M. E. Kastner, Department of Chemistry, Bucknell University, Lewisburg, PA 17837; R. Blatchley, Mifflinburg Area High School, 1 & Market Street, Mifflinburg, PA 17844

High school students researched, wrote and produced a videotape about Joseph Priestley, the discoverer of oxygen. This program is directed toward middle and junior high school students and presents an historical perspective of Priestley's work, and its impact on chemistry. Demonstrations performed at the Priestley House highlight the production.

HS-04

HISTORY OF CHEMISTRY-HISTORY OF SCIENCE: A STUDY TOUR. Sue Grindstaff and Wyman Grindstaff, Department of Chemistry, Southwest Missouri State University, Springfield, MO. 65804. A second History of Science Study Tour to England was completed in January, 1986, with positive results so that a third tour has been planned to include England and France. A study-tour to Europe can be an excellent educational opportunity for science majors, minors and even general education science students. We suggest that the service role played by most chemistry departments makes chemistry faculty members ideal teachers of the history of science and tour directors. Details of the tour will be presented including course content and the travel component.

HS-05 AN UPDATE OF THE EUROPEAN HISTORY OF CHEMISTRY TOURS. John H. Wotiz, Department of Chemistry and Biochemistry, Southern Illinois University, Carbondale, Illinois 62901.

Since the first European History of Chemistry Tour was organized by the presentor in 1971, significant changes have been enacted. Colored slides of museums and sites visited by the tour members will be shown to illustrate the diversified program and itinerary. A questionnaire will be available to learn from the Bozeman Conference participants their preferred options in the 1987 tour.

HS-06 KEKULE AND THE RULES OF EVIDENCE IN HISTORY OF CHEMISTRY. John H. Wotiz and Susanna Rudofsky, Department of Chemistry and Biochemistry, Southern Illinois University, Carbondale, Illinois 62901.

The authors presented the paper "Chemistry Education and the Kekulé Myth" at the Sept. 1985 Chicago ACS meeting. The paper also appeared in the Spring 1986 issue of the 2YC Distillate. Subsequently, the authors received several additional examples of fictionalized versions of the Kekulé mythical dream. Examples came out of essoteric books and publications, some completely unknown to the presentor, who will share some contents with the Bozeman Conference participants.

The anectodal accounts of Kekulé's mythical dreams will give the educators a good opportunity to discuss with their students "rules of evidence" in science.

HS-07

THE DEVELOPMENT OF THE MODERN PERIODIC TABLE, Diane L. Gerlach, Tremper High School, Kenosha, WI 53142.

Chemists often speak of the periodic table as though there were only one. Actually, there are more than one hundred different types of periodic tables that have been developed by chemists in the search for a perfect form which expresses all of the periodic relationships of the elements.

The idea of periodic relationships among the elements has a long history from the time of Lavoisier to that of Meyer and Mendeleer. Many of the ideas contributed to the growing body of knowledge and understanding and many were proved to be of little value. A survey of the chemists involved in the long search for an understanding of periodic relationships provides insight into the process of the intellectual development of periodic systems. Hands-on exercises for introducing periodicity to high school students will also be introduced.

HS-08 LIEBIG AND LAVOISIER. Crabtree AL, Shawnee Mission South High School, 5800 W. 107th Street, Shawnee Mission, KS 66207.

A walk through Liebig's laboratory that drastically changed chemistry education, artifacts from Lavoisier's experiments and some insight to Faraday's personality will be presented via a slide-lecture presentation. Information comes from a trip through Europe with emphasis on history of chemistry.

Monday, July 28, 1986
Innovative Courses
Strand Union Ballroom - D

2:45PM
Introduction
Session Chair, **Appleman J**

2:50
IC-01
CHEMCOM--UPDATE FROM THE FIELD TEST
Lippincott WT, **Ware SA**, Heikkinen H

3:10
IC-02
WHY AND HOW TO ORGANIZE AN INTERDISCIPLINARY ENERGY COURSE
Koubek E

3:35
IC-03
ENTER: A PREP. COURSE EXIT: TO WHERE?
Bartley EA

3:50
IC-04
A COMMUNITY COLLEGE PROGRAM FOR THE TRAINING OF TECHNICIANS
Kenkel JV

4:05
IC-05
INTERRELATED SUMMER COURSES FOR TEACHERS AND STUDENTS
White JE, Carter VB, Zurheide FW

4:20
IC-06
EXTENSION/CORRESPONDENCE TEACHING OF GENERAL CHEMISTRY
Carr JD

4:35
IC-07
TRAINING OF CHEMISTS THROUGH DISTANCE TEACHING IN MALAYSIA
Darus H

4:50
IC-08
CHEMISTRY FOR NONSCIENTISTS: A DILUTE SOLUTION
Bonicamp JM

5:05
IC-09
OFF CAMPUS CHEMISTRY: TEACHING CHEMISTRY WITHOUT CAMPUS FACILITIES
Baker CR, East JR

IC-01 CHEMCOM--UPDATE FROM THE FIELD TEST. S.A. Ware, Educational Services Department, American Chemical Society, Washington, D.C. 20036.

Chemistry in the Community (CHEMCOM) is an alternative chemistry course for the general student at the high school level. CHEMCOM covers that chemistry needed by students concerned with understanding a series of community issues involving chemistry. These issues include water and air pollution, resource management, appropriate nutrition and health care, petroleum as a fuel and a feedstock, nuclear chemistry and its uses, and the role of the chemical industry on the local and national scene. CHEMCOM is currently being field tested in schools in 13 states around the country. This short presentation is an introduction to the workshop on the same topic.

IC-02 WHY AND HOW TO ORGANIZE AN INTERDISCIPLINARY ENERGY COURSE, E. Koubek, Chemistry Department, U.S. Naval Academy, Annapolis, MD 21402.

Did you meet a stranger at a Christmas party last year only to find out that he's been a member of your economics department for 15 years? Do you think the solution to our energy problems are all technical? Are you tired of teaching the same old classes? Do you enjoy doing extra work for no extra pay? If so, maybe you should consider organizing an interdisciplinary energy course. I did and found it an interesting experience.

IC-03 ENTER: A PREP. COURSE EXIT: TO WHERE?
Edith A. Bartley, Tarrant County Junior College, South Campus
5301 Campus Dr., Fort Worth, TX 76119

Through the years students beginning in the science major's class have been unable to master the material due to lack of previous high school chemistry or weak mathematical background. In order to assist the student's acquiring this minimum background, our department instituted a preparatory course. Since admission was not determined by examination, the student was given the suggestion to take the course prior to attempting the freshman level chemistry course.

An examination of the last couple of year's classes was made to give an insight as to the actual student's use versus our intended use of the preparatory course.

IC-04 A COMMUNITY COLLEGE PROGRAM FOR THE TRAINING OF TECHNICIANS
John V. Kenkel
Southeast Community College
8800 "O" Street
Lincoln, NE 68520

A two-year technician training program which takes a somewhat novel approach to the issue of training of chemical technicians will be described. In this approach, existing introductory or preparative level chemistry courses are utilized during the first year of training and an intensive analytical chemistry sequence tailored to technicians is taught the second year. In addition, a microbiology course sequence and Water/Wastewater course sequence are also required, thus making job opportunities in those fields also available to the graduate.

IC-05 INTERRELATED SUMMER COURSES FOR TEACHERS AND STUDENTS.

J.E. White, V.B. Carter, Department of Chemistry, and F.W. Zurheide, Department of Physics, Southern Illinois University at Edwardsville, Edwardsville, IL 62026-1652

Teachers and students learned together in Summer '86 in the first trial of a new program. Teachers of high school chemistry and physics enrolled in a graduate course and were awarded teaching assistantships. They were assigned to help in two enrichment courses taken by high school students or recent graduates who had completed two years of chemistry or one year of physics. These "honors" courses were designed to "top off" the students' varied backgrounds, preparing them to pass a proficiency exam in general chemistry or in general physics and to develop the laboratory skills needed to proceed to advanced courses. The teachers met separately for lectures and discussion of teaching methods and to try the experiments. In the labs, they worked closely with the students. Topics covered and experiments done will be described.

IC-06 EXTENSION/CORRESPONDENCE TEACHING OF GENERAL CHEMISTRY.

James D. Carr Dept. of Chemistry, University of Nebraska, Lincoln, 68588-0304

Videotapes of first-semester chemistry lectures have been prepared utilizing a combination of presentations. The majority of the new material is presented via audio presentation keyed to video shows which incorporate short messages, animation, dissolve techniques and actual pictures of chemical processes. Following a six-eight minute presentation of this type, an instructor solves problems related to the topic and shows demonstrations of chemical reactions and measurements. All this is coordinated with a written study guide and a major college textbook. The intent is to simulate as closely as possible an actual live lecture course in first semester general chemistry. A student registering for such a course will be mailed a videotape in either VHS or Beta format which will include about two weeks of lecture material. The student will view the tapes on a personally owned VCR and at the students own schedule. Following return of the tape with a selection of worked-out problems, an exam will be mailed to a designated proctor to administer to the student.

Samples of the videotape production will be shown and described.

IC-07 TRAINING OF CHEMIST THROUGH DISTANCE TEACHING IN MALAYSIA.

H. DARUS COCS, Universiti Sains Malaysia, 11800, Penang, Malaysia.

Distance teaching is a new method of providing university education for adult students in Malaysia. One of the subjects taught through this medium is chemistry. Whether chemists can be trained by this method or not is a question that need serious attention. In Malaysia the training of a chemist by distance teaching has been carried out by the center for off-campus studies at Universiti Sains Malaysia for over a decade. This program has managed to produce excellent results as indicated by graduates who had obtained good honors degree. Chemistry is a laboratory based subject and it is not easy to have laboratories at every study center especially for the higher level courses. Therefore some modification has to be made in the study programs so as not to deprive them of laboratories experiences. A conventional chemistry teaching methods are not suitable for distance learning. In this paper the method of training professional chemists through distance teaching in Malaysia will be presented.

IC-08 CHEMISTRY FOR NONSCIENTISTS: A DILUTE SOLUTION. Judith M. Bonicamp, Department of Chemistry and Physics, Middle Tennessee State University, Murfreesboro, TN 37132.

The Department of Chemistry and Physics offers the one-semester course Topics in Physical Science to nonscience majors as part of the general studies curriculum. The course emphasizes the language, development, structure and role of chemistry, physics, astronomy, and geology as they relate to the knowledge and activities of the educated person. A goal of the physical science course is to develop scientifically literate citizens who will have sufficient knowledge and understanding of the fundamental concepts of chemistry and the other physical sciences for effective participation in 20th and 21th century life. Chemists agree that prospective chemists need a sound background in practical and theoretical chemistry for job success, but the question of what of chemistry a citizen should know, and how one can convey that essential part of science hasn't a simple answer. A chemistry teacher confronted with teaching physical science must face additional problems: how to integrate chemistry into the other fields such as geology, how to handle the few chemistry chapters some physicist has deposited in a physical science text, and how to cover the four areas of physical science in one brief semester. The paper will address these issues and will present student reactions to the chemistry section of the physical science course.

IC-09 OFF CAMPUS CHEMISTRY: TEACHING CHEMISTRY WITHOUT CAMPUS FACILITIES. Charles R. Baker and James R. East, Indiana Univ-Purdue Univ at Indianapolis, Indianapolis, IN 46202.

Awareness of the role played by science and technology in modern life is the goal of many non-science, post secondary curricula. As one method of achieving this goal, Indiana University enters into community linkage plans that permit courses to be taught at locations within neighborhoods conveniently accessible to students. The speaker has participated in two such arrangements.

Learn and Shop is a formal program operated from Indiana University-Purdue University at Indianapolis. Courses are presented in rooms donated by department stores in shopping malls. Chemistry has been offered since the inception of Learn and Shop.

The rooms contain no laboratory or demonstration facilities. These vital dimensions of chemistry must be replaced with activities involving the students themselves. The speaker will present methods used to develop interest in science within the non-major student, especially under off campus conditions. A discussion of methods used by others who have taught similar students is encouraged.

Monday, July 28, 1986
Teaching Organic Chemistry II
234 Gaines Hall

2:45PM
Introduction
Session Chair, **Henderson JW**

2:50
OR-06
NITRATION OF HYDROXYAROMATIC CARBONYL COMPOUNDS
McGahey L

3:10
OR-07
THE USE OF MOLECULAR MODELS IN TEACHING ORGANIC CHEMISTRY
Rosenfeld SM

3:30
OR-08
PHOTOISOMERIZATION OF 2'-ACETOXYCHALCONE AND RELATED COMPOUNDS
Kohrman RE

3:50
OR-09
ACID-BASE CONCEPTS IN THE UNDERGRADUATE ORGANIC COURSE
Berry Jr RA

4:10
OR-10
SYSTEMATIC OPTIMIZATION OF EXPERIMENTAL PARAMETERS, TEDIOUS BUT PRODUCTIVE.
Currie Jr JO, Eisenhauer JP

4:30
Discussion

OR-06 NITRATION OF HYDROXYAROMATIC CARBONYL COMPOUNDS Lawrence McGahey. Chemistry Department, Union College, Schenectady, NY 12308.

The nitrite-catalyzed nitration of methyl salicylate with dilute nitric acid in acetic acid solution was investigated to develop a laboratory exercise to replace the nitration of phenol. Nitration does not occur by direct electrophilic attack of nitronium ion on the aromatic ring, but rather through a nitrosation-oxidation mechanism. Approximately equal amounts of methyl 2-hydroxy-3-nitrobenzoate and 2-hydroxy-5-nitrobenzoate are thus obtained, for a total yield of about 75%. Recrystallization of the nitro esters affords a eutectic mixture, and neither isomer is steam-volatile. Separation of the nitro acids was achieved quite readily by saponification of the nitro esters, followed by recrystallization of the potassium monocarboxylates from potassium carbonate solution. The total yield of the nitro acids was about 70% based on starting methyl salicylate. The nitration of salicylic acid, methyl *m*-hydroxybenzoate, methyl *p*-hydroxybenzoate, and *m*-hydroxyacetophenone will be discussed briefly.

OR-07 THE USE OF MOLECULAR MODELS IN TEACHING ORGANIC CHEMISTRY. Stuart M. Rosenfeld, Department of Chemistry, Smith College, Northampton, Massachusetts 01063.

Organic chemistry instructors generally rely heavily on a wide variety of two-dimensional representations to convey information on molecular structure. Most 2-D representations are derived from consideration of three-dimensional models and they typically embody 3-D aspects of structure. Students comprehend and use 2-D representations with varying degrees of skill depending upon how well they appreciate the relationship between a given 2-D representation and its 3-D counterpart. Experience in handling molecular models is, of course, central to this sort of learning. Unfortunately, students rarely take full advantage of their molecular model sets. Projection of stereo pictures of molecular models motivates students to use their own model sets and also provides a bridge between 2-D and 3-D models for those who continue to resist the advice to use models. This presentation will demonstrate the advantages of stereoscopic projection, citing some of the unique teaching opportunities that are available when using this technique.

OR-08 PHOTOISOMERIZATION OF 2'-ACETOXYCHALCONE AND RELATED COMPOUNDS, R.E. Kohrman, Department of Chemistry, Central Michigan University, Mt. Pleasant, Michigan 48859.

The undergraduate organic chemistry laboratory course is often lacking in photochemical experiments which are both instructive and yet able to be completed within a short time frame. An experiment involving cis-trans photoisomerization of 2'-acetoxychalcone and related compounds has been developed which illustrates a rapid photoreaction and is also amenable to quantitative analysis. The desired chalcone is easily synthesized from o-hydroxyacetophenone, and a 10^{-3} M solution of the chalcone in methanol is irradiated at 254 nm using a Rayonet Photochemical Reactor. Significant reaction occurs within 30 minutes and the transformation may be monitored by nmr, uv and chromatographic methods. The details of this experiment and its application to the undergraduate organic laboratory course will be presented.

OR-09 ACID-BASE CONCEPTS IN THE UNDERGRADUATE ORGANIC COURSE. R. A. BERRY, JR., Department of Chemistry, Millsaps College, Jackson, MS 39210.

Most organic text books present acid-base reactions throughout the text but do not emphasize their relationships. This neglects an important conceptual relationship that can add to the student's overall understanding of organic chemistry. In this paper, comparisons and conceptual acid-base relationships are made for several functional group families. Also, acid-base chemistry provides a much better model for teaching inductive and resonance substituent effects than the traditionally used electrophilic substitution reactions.

OR-10 SYSTEMATIC OPTIMIZATION OF EXPERIMENTAL PARAMETERS, TEDIUS BUT PRODUCTIVE. J.O. Currie, Jr., J.P. Eisenhauer, Chemistry Department Pacific University, Forest Grove, OR 97116

As professional chemists, we often do not subject a new reaction to a systematic optimization of experimental parameters. Instead we usually use our experience to select what we think will be the best conditions and then consider variations around these. In our laboratories, as part of a longer synthetic sequence, we encountered great difficulty in preparing a dimethylhydrazone. This paper describes a systematic evaluation of conditions using both a model compound and then the target molecule. The value of this type of research as a student project also will be discussed.

Monday, July 28, 1986

Dreyfus Presents

101 Gaines Hall

2:45PM
Introduction
Session Chair, Rand R

This session has been added at proof stage and times are not given. Session chair should apportion time as she deems best. References are given to the abstracts, which appear elsewhere in the program.

See Abstract HS-07 (History of Chemistry, Monday afternoon)

DEVELOPMENT OF THE MODERN PERIODIC TABLE Gerlach DL

See Abstract DE-10 (Demonstations by Demonstration II, Tuesday morning)

ENRICHMENT OF DESCRIPTIVE CHEMISTRY THROUGH STUDENT PERFORMED DEMONSTRATIONS Shelly K, Zoltewicz S

See Abstract DE-06 (Demonstrations by Demonstration I Monday morning)

ITS ALL IN HOW YOU TEACH IT! Burnett DW

See Abstract DE-21 (Demonstrations by Demonstration (III), Wednesday afternoon)

YOU LEAD THEM TO LAB, CAN YOU MAKE THEM THINK?
Schrader, CL

Monday, July 28, 1986
POSTERS I
276 Strand Union Building

2:45-5:15PM

PO-01
TEACHING MOLECULAR GEOMETRIES IN GENERAL CHEMISTRY LABORATORY THROUGH THE IDENTIFICATION OF BASIC SYMMETRY ELEMENTS IN MODELS
Drake RF

PO-02
NUMERICAL METHODS ON A SPREADSHEET
Coe DA

PO-03
ENJOYING CHEMICAL DATA PROCESSING WITH MINITAB
Pollnow GF

PO-04
BIOPHYSICAL CHEMISTRY EXPERIMENT: MICRO-COMPUTER ANALYSED INITIAL RATE KINETICS OF BENZENE-ENHANCED UNFOLDING OF MYOGLOBIN
Schuh MD

PO-05
A COMPLETE LABORATORY SYNTHESIS OF ASPARTAME USING ENZYMATIC COUPLING OF PROTECTED AMINO ACIDS
Kroll LR, Inman KC

PO-06
A SAFE MOLAR VOLUME-MOLAR MASS EXPERIMENT TO REPLACE THE HAZARDOUS PROCEDURE INVOLVING THE THERMAL DECOMPOSITION OF POTASSIUM CHLORATE
Bedenbaugh JH, Bedenbaugh AO

PO-07
A QUALITATIVE-QUANTITATIVE 1H NMR EXPERIMENT FOR THE INSTRUMENTAL ANALYSIS LABORATORY
Phillips JS, Leary JJ

PO-08
UNDERSTANDING ACID-BASE CHEMISTRY: THE MARRIAGE OF STOICHIOMETRY AND EQUILIBRIUM
Lewis DA

PO-09
HAZARDS IN A PHOTOGRAPHY LAB... A CYANIDE INCIDENT CASE STUDY
Houk CC

PO-10
TEACHING LEWIS STRUCTURES USING ELECTRON-BAR DIAGRAMS
Zidick C

PO-11
INEXPENSIVE VISUAL AIDS
Nickels W

PO-12
CHEM CARD
Bixler B

PO-13
NEED FOR A CLEAR DEFINITION OF THE QUANTITY MEASURED BY THE UNIT MOLE...WHAT ABOUT NUMEROSITY?
Rocha-Filho RC

PO-14
EXPERIMENTAL DETERMINATIONS OF RATE CONSTANTS USING ONLY WATER AND GLASSWARE
Stone HM

PO-01 TEACHING MOLECULAR GEOMETRIES IN GENERAL CHEMISTRY LABORATORY THROUGH THE IDENTIFICATION OF BASIC SYMMETRY ELEMENTS IN MODELS. Robert F. Drake, Department of Chemistry, Northland College, Ashland, WI 54806.

Students often have difficulty visualizing and sketching molecular geometries necessary for the complete understanding of such topics as VSEPR theory and molecular polarity. A model-building experiment suitable for general chemistry laboratory use will be described which has proved effective in helping students retain visual images of molecular shapes by requiring that they study models they build themselves and identify basic symmetry elements, and that they then sketch the shapes from the models.

PO-02 NUMERICAL METHODS ON A SPREADSHEET, Douglas A. Coe, Department of Chemistry and Geochemistry, Montana College of Mineral Science & Technology, Butte, MT 59701.

Electronic spreadsheets are an alternative to writing programs to solve computational problems requiring numerical methods for their solution. Spreadsheets are easier to format, easier to edit and debug, and, in general, take less time to set up for a particular application than programs. In this paper examples will be given of using spreadsheets to carry out iterative solutions, using Newton's method, to perform numerical integrations, and to apply Euler's method in solving systems of first order differential equations.

PO-03 ENJOYING CHEMICAL DATA PROCESSING WITH "MINITAB", Gilbert Pollnow, Dept. of Chemistry, University of Wisconsin, Oshkosh, WI 54901

MINITAB is a powerful software program originally developed on a mainframe for students in introductory statistics courses at Penn State. It's capabilities have been expanded to the extent that it is now licensed world wide. It's use in Chemistry is a natural extension, since many problems involve data manipulation, various forms of correlations, regressions, tabulations, and graphics. The commands are similar to BASIC in form, but with each variable representing a whole column of data. Thus, the single command, REGRESS C3 2 C1 C4 C5 C6 performs a quadratic regression of the data in columns C3, C1, C4; with C5 the column of residuals, and C6 the fitted values of the Y-coordinates. The original and fitted data can both be plotted on the same graph with MPLOT C3 C1 C6 C1, or listed in columns with PRINT C1-C6. CORR C1-C6 generates the entire table of possible correlations between the six columns of data. MINITAB is now available for the IBM PC, and most other popular microcomputers with 256 K memories, and can be interfaced with LOTUS 1-2-3. The workshop will provide individual hands-on instruction on a variety of applications in the lecture and laboratory. Participants are urged to bring along any problems of interest. MINITAB is a registered trademark of Minitab, Inc.

PO-04 BIOPHYSICAL CHEMISTRY EXPERIMENT: MICRO-COMPUTER ANALYSED INITIAL RATE KINETICS OF BENZENE-ENHANCED UNFOLDING OF MYOGLOBIN, Merlyn D. Schuh, Department of Chemistry, Davidson College, Davidson, NC 28036

Interactions that control the conformations of globular proteins are of considerable interest to biochemists (1). In order to demonstrate such important studies to chemistry students, we have developed an experiment based on the previous work of J. R. Cann (2).

Small amounts of benzene dramatically enhance the unfolding of myoglobin induced by urea, and the reaction is followed by monitoring the Soret absorbance. Plots of absorbance vs time are fitted with a polynomial regression, and the rate of reaction at time zero is obtained directly from the derivative of the polynomial equation (3). Use of the method of initial rates overcomes the problem associated with the likely change in reaction order with time. Consideration of the reaction order with respect to benzene and the reported x-ray crystallographic structure of myoglobin permits an attempt to identify specific aromatic residues that control the protein conformation.

(1) C. Chothia, Ann. Rev. Biochem. 53 (1984) 537.
(2) J. R. Cann, Biochem. 6 (1967) 3427.
(3) K. J. Hall, T. I. Quickenden and D. W. Watts, J. Chem. Ed. 53 (1976) 493.

PO-05 A COMPLETE LABORATORY SYNTHESIS OF ASPARTAME USING ENZYMATIC COUPLING OF PROTECTED AMINO ACIDS, LeRoy C. Kroll, Department of Chemistry, Taylor University, Upland, IN 46989 and Karen C. Inman, Department of Chemistry, Box H, Brown University, Providence, RI 02912.

A tested and modified version of the Aspartame synthesis laboratory experiment first reported by us in preliminary form at the A.C.S. National Meeting in St. Louis (187th A.C.S. National Meeting, CHED paper 89) has been developed. The experiment uses the enzyme Thermolysin (EC 3.4.24.4) to catalyze the coupling of N-Carbobenzoxy-L-Aspartic Acid with the Methyl Ester Hydrochloride of L-Phenylalanine, followed by the Palladium-catalyzed deprotection of the Aspartic Acid amino group using hydrogen-transfer hydrogenolysis. Routine yields of 0.5 g of crude Aspartame are found to be typical; further purification gives nearly pure Aspartame in 0.1-0.2 gram yields. A simple TLC analysis permits students to verify product identity. The average total cost per student is about $12.00, comparable to or better than many other reported peptide synthesis experiments, and no specialized equipment is required.

PO-06 A SAFE MOLAR VOLUME-MOLAR MASS EXPERIMENT TO REPLACE THE HAZARDOUS PROCEDURE INVOLVING THE THERMAL DECOMPOSITION OF POTASSIUM CHLORATE.

John H. Bedenbaugh and Angela O. Bedenbaugh, Department of Chemistry, University of Southern Mississippi, Hattiesburg, MS 39406-8466

Oxygen for use in demonstrations can be prepared conveniently by the decomposition of aqueous hydrogen peroxide solutions with bakers' yeast. This reaction, catalyzed by catalase in the yeast, was first reported years ago but is not widely used. We have developed a procedure, based on this reaction, which we propose as a safe, simple, economical replacement for the classic but dangerous thermal decomposition of potassium chlorate in molar volume and molar mass experiments. Moreover, the hydrogen peroxide decomposition procedure offers the opportunity of determining the concentration of aqueous hydrogen peroxide solutions as an added feature of the overall experiment. Finally, for those who have limited resources this experiment offers the option of conducting these quantitative procedures without the use of a balance because the liquid reactant allows a volumetric rather than a gravimetric method to be employed. Essential details of the experimental procedure will be given and typical results will be presented.

PO-07 A QUALITATIVE - QUANTITATIVE ^{1}H NMR EXPERIMENT FOR THE INSTRUMENTAL ANALYSIS LABORATORY.

John S. Phillips, Department of Chemistry, University of Wisconsin-River Falls, WI 54022. James J. Leary, Department of Chemistry, James Madison University Harrisonburg, VA 22807.

Nuclear Magnetic Resonance (NMR) spectroscopy may be used for both qualitiative and quantitative analysis. Due to the power of NMR in the determination of structure of organic molecules, students are introduced to the qualitative aspects of NMR in most contemporary organic chemistry courses, laboratories and textbooks. An instrumental analysis experiment for the determination of the molecular mass and structure of an unknown compound will be described. The unique aspect of this experiment is that it utilizes previous student knowledge of qualitative NMR, while illustrating the quantitative potential of the NMR method. It is one of the few instrumental analysis experiments that requires the use of both qualitative and quantitative information, obtained from a single instrument, for the solution of a single problem.

PO-08 UNDERSTANDING ACID-BASE CHEMISTRY : THE MARRIAGE OF STOICHIOMETRY AND EQUILIBRIUM,

D. A. LEWIS, DEPARTMENT OF CHEMISTRY, ROSE-HULMAN INSTITUTE OF TECHNOLOGY, TERRE HAUTE, INDIANA 47803

We previously reported a modified approach to teaching acid-base chemistry which centers on the strong acid-strong base neutralization reaction rather than the self-ionization of water. The strong acid-strong base titration reaction and the accompanying pH calculations are covered in detail to the equivalence point and beyond; the magnitude of the equilibrium constant for this reaction, which is $1/K_w$, is discussed. This reaction is then used as a "reference" against which both the equilibrium constants and the pH values in any weak acid-strong base or strong acid-weak base titration are constantly compared. One advantage of this "comparison" method over the present textbook approach is that the student can immediately see why the pH at the equivalence point in a weak acid-strong base or strong acid-weak base point titration cannot be 7. We have also found that both the qualitative and quantitative aspects of aqueous salt solutions are more easily handled using the neutralization approach.

PO-09 HAZARDS IN A PHOTOGRAPHY LAB...A CYANIDE INCIDENT CASE STUDY. Clifford C. Houk, Department of Chemistry and Charles Hart, Department of Environmental Health and Safety, Ohio University, Athens, Ohio 45701-2979.

Hydrogen cyanide gas was apparently released during a demonstration illustrating how artists may draw designs on existing photographs using cyanotype (blueprinting) processes. The history, investigation and results of the incident will be presented along with recommendations for prevention of additional incidents. Appropriate health and safety guidelines for photography/art labs or studios will be presented.

PO-10

TEACHING LEWIS STRUCTURES USING ELECTRON-BAR DIAGRAMS. Clement Zidick, Chemistry Department, Luther College, Decorah, Iowa 52101.

A method to teach Lewis structures without the usual dot diagrams will be explained. The method makes use of an "electron-bar" to represent an electron pair. The presentation will include examples that conform to octet rules, free radical and resonance forms, structures beyond the octet rule, and use of VSEPR theory to predict shapes of some of the molecular structures discussed.

PO-11 INEXPENSIVE VISUAL AIDS. William Nickels, Department of Chemistry, Schoolcraft College, 18600 Haggerty Road, Livonia, MI 48152.

Sensational photographs of fires and explosions are appearing as a result of new technology that allows newspapers to print color photographs.

Pictures of an overturned nitric acid tank car producing a brown gas, a fire radiating bright white light, a factory fire producing black smoke, a space shuttle launch producing white smoke, and other photographs will be displayed.

These pictures provide teachers an inexpensive and relevant opportunity to example material and energy products of different chemical changes. Students and teachers also may speculate about the identity of the reactants in the photographed changes.

PO-12 CHEM CARD, t.m. 1984, C. J. Bixler
Math Science Department, Durham Technical Institute, Durham, NC 27703

A game to provide an enjoyable hands-on way to learn how elements combine into compounds. In "Chem Fish" each player is dealt cards from a deck of chemical symbols and must form compounds with cards from his own hand, from the deck or from the other players. This shows visually how oxidation numbers determine the correct chemical formula of a compound. "Periodic Poker" also gives students practice calculating formula weights of compounds. The game includes a card deck of 36 of the most common elements and complex ions, rules for "Chem Fish" and "Periodic Poker," score sheets, and a table of oxidation numbers. For 2-6 players, high school through freshman year chemistry (introductory chemistry). Approximate playing time per game - 30 min. to 1 hr.

PO-13 THE NEED FOR A CLEAR DEFINITION OF THE QUANTITY MEASURED BY THE UNIT MOLE: WHAT ABOUT NUMEROSITY?

R.C. Rocha-Filho, UFSCar, C.P. 676, 13560 S.Carlos - SP, Brazil

The name and meaning of the physical quantity measured through the unit mole - *amount of substance* - has been a matter of controversy and confusion ever since it was introduced. As pointed out by Gorin (*J.Chem.Educ.*, 1982, 59, 508), "amount" can refer indiscriminately to mass, volume or number of entities. Of these, only the last one is not clearly related to an SI unit. However, a) the mole is often referred to as the "chemist's dozen"; b) the dozen is used to state the total number of entities in a numerous set; c) the mole is a unit used to state the number of entities in very numerous sets; d) the quality or state of being numerous is the numerousness or *numerosity*: "the earliest scales of measurement were scales of numerosity - scales for the counting of pebbles, ..."(*Webster's Third International New Dictionary*, 1966, V.2, p.1550). Thus, it is here proposed that mole be a unit of the quantity *numerosity*; other units: dozen, gross etc., mole being the one encompassing the largest number of entities. The definition of mole could, then, read as: "mole: numerosity equal to the number of atoms in 0.012 kg of carbon-12". This definition gives mole an unlimited scope (today restricted to substances) and relates it to a clearly defined physical quantity.

(CAPES/PADCT)

PO-14 EXPERIMENTAL DETERMINATION OF RATE CONSTANTS USING ONLY WATER AND GLASSWARE.

Helen M. Stone, Ben L. Smith High School, 2407 South Holden Road, Greensboro, NC 27407

This lab for first or second-year high school students requires only water and readily available glassware and allows the student to *SEE* what we mean when we say, "Rate," "specific rate constant," "first-order," "equilibrium," or even "plotting the natural log of amount vs concentration yields a straight line of constant slope." By measuring remaining volume at each "time" interval, the student is able to determine experimentally (1) R_f, (2) R_r, (3) k_f, (4) k_r, and (5) K_{eq}. Students are required to plot a number of graphs in order to display the various relationships. Participants will receive a lab handout with sample data and graphs as well as a copy of solutions and graphs for "Equilibrium Dance Floor Problem," originally published in *Chem13News*

Monday, July 28, 1986
The Chemistry Olympiad
Strand Union Ballroom - C

8:00PM
Introduction
Session Chair, M. Gardner

8:05
OL-01
ACS CHEMISTRY OLYMPIAD PROGRAM
Cook WB

8:20
OL-02
HIGH SCHOOL AND ACS LOCAL SECTION PARTICIPATION
Beiler TW

8:35
OL-03
THE TESTING PROGRAM
Davis J

8:50
OL-04
INTERNATIONAL CHEMISTRY OLYMPIAD: US PREPARATION AND PARTICIPATION
Hampton MD, Key ME, Wright J, Smith P, Avila W

9:10
OL-05
TWO APPROACHES TO THE CHEMISTRY OLYMPIAD
Butchcroft A

9:25
Discussion

OL-01] ACS Chemistry Olympiad Program. William B. Cook, Department of Chemistry, Colorado State University, Fort Collins, Colorado 80523.

The USA first participated in international competition for high school chemistry in 1984. Other nations had participated for a score of years. This talk will provide information about the ACS-Society Committee on Education decisions, first not to participate, then to participate; the basis for the national competition; the organization; the support and the future outlook. Recently Dr. John Crum, Executive Director of the ACS wrote to the ACS Board of Directors:

> I think it is fair to say that, with the possible exception of CHEM MATTERS, no ACS initiative of recent years has more completely captured the imagination of the high school chemistry community, and of the many ACS local sections who work with the high schools, than has the ACS Chemistry Olympiad.

OL-02 High School and ACS Local Section Participation. Theodore W. Beiler, Department of Chemistry, Stetson University, DeLand, Florida 32720

The near tripling of participation in its first three years shows that ACS members endorse the Olympiad concept, and over 80% of all ACS members are in participating sections. This success is tempered, however, in that about 40% of those sections with fewer than 500 members do not participate. The heart of the Olympiad competition is participation of as many high schools as possible. Local Sections can play a key role in developing interest, providing recognition, and upgrading instruction. How this cooperative stimulation can be done will be discussed, with attention to the problems encountered, particularly by the smaller sections.

OL-03 The Testing Program. Jefferson Davis, Department of Chemistry, University of South Florida, Tampa, Florida 33620

The primary component in the selection of 20 students to attend the Chemistry Olympiad study camp is a national examination administered by ACS local sections. This exam consists of two parts, a two hour 70 item objective (multiple choice) exam, and a two hour portion requiring written explanations of phenomena, detailed problem solving, and related topics requiring students to express themselves clearly and correctly. Emphasis in both parts is on fundamental facts and theory, quantitative abilities, laboratory methodology, and basic understanding of descriptive organic, inorganic, and biochemistry. Details of exam philosophy, grading, and student selection will be discussed.

OL-04 International Chemistry Olympiad: United States Preparation and Participation. Michael D. Hampton, Mary E. Key, James Wright, Patricia Smith, Water Avila, Department of Chemistry, University of Central Florida, Orlando, Florida 32816

The United States participated in the International Chemistry Olympiad for the first time in 1984. To prepare for this event a multitude of American high school students were screened. By means of a written exam twenty high school chemistry students were selected to attend a two week study camp. During this study camp the students were exposed to an intensive program of both theoretical and practical chemistry. At the conclusion of the study camp the top four students were chosen for the team to represent the U.S. at the International Chemistry Olympiad. These four students then participated in the Olympiad which was held in Frankfurt, West Germany. The process was repeated for the XVIII International Chemistry Olympiad which was held in Bratislava, Czechoslovakia in 1985. The selection process, study camp, and International Chemistry Olympiad will be discussed.

OL-05 **TWO APPROACHES TO THE CHEMISTRY OLYMPIAD. Alan Hutchcroft, Dept. of Chemistry, Rockford College, Rockford, IL 61108-2393.**

The Rock River Valley Section (a small ACS section) has participated in the Chemistry Olympiad for two years. The first year we invited nominations from area high schools and selected five students to take the national exam. This year we utilized the ACS provided Local Section Exam for award competition at the first and second year level as well as to choose five students to take the national exam. The separate level contest and cash awards were popular with teachers and students. Details and examples of our announcements and other communications will be provided.

MONDAY, JULY 28, 1986
Innovative Programs
Strand Union Ballroom - B

8:00PM
Introduction
Session Chair, **Bowers CH**

8:05
IP-01
CHEMISTRY, PHYSICS AND BIOLOGY FOR SECONDARY TEACHERS
Bauman, JE

8:15
IP-02
UPGRADING TEACHERS' CHEMISTRY KNOWLEDGE: TRIALS & TRIBULATIONS ASSOCIATED WITH IMPLEMENTING A COLLABORATIVE PROJECT
Greenbowe TJ, Pulliam EJ

8:25
IP-03
COLLEGE FACULTY CAN INFLUENCE HIGH SCHOOL CHEMICAL EDUCATION-AN UPDATE
Bedenbaugh JH, Bedenbaugh AO

8:35
IP-04
FEDERAL AND STATE SUPPORT FOR A SUMMER HIGH SCHOOL CHEMISTRY TEACHERS COURSE
Jensen WP, Clausen W, Martin J, Mehlbrech T

8:45
IP-05
INTENSIVE WORKSHOPS FOR JR. HIGH/HIGH SCHOOL TEACHERS
Marcello JA

8:55
IP-06
THE DEVELOPMENT OF AN IN-SERVICE WORKSHOP PROGRAM FOR SECONDARY SCHOOL TEACHERS
Erdman R, Glahn M, **Soloff L**, Williamson C

9:05
IP-07
THE PERQUISITES OF PARTICIPATING
Freeman M, Grosse C, Gonzalez B, Noel P

9:25
IP-08
INNOVATIVE APPROACHES TO IMPROVEMENT OF SECONDARY SCIENCE EDUCATION
West WE, Marek L

IP-09
INNOVATIVE PROGRAMS FOR THE IMPROVEMENT OF SCIENCE EDUCATION
William E. West

9:35
Discussion

IP-01 CHEMISTRY, PHYSICS AND BIOLOGY FOR SECONDARY TEACHERS. J. E. Bauman, Department of Chemistry, University of Missouri, Columbia, MO 65211.

A program entitled Science as a Way of Knowing involved the combined efforts of University professors of chemistry, physics and biology; science education personnel from the College of Education and master high school teachers. A series of three workshops was presented at each of three satellite stations. Topics covered included Matter and energy, water and gases, and light and radiation. A summer school on-campus program reflected these three topics in weekly segments. Analysis of the program from the standpoint of participants as well as the views of three categories of instructors is shown. The importance of workshops integrated both in content and in process is illustrated.

IP-02 UPGRADING TEACHERS' CHEMISTRY KNOWLEDGE: TRIALS AND TRIBULATIONS ASSOCIATED WITH IMPLEMENTING A COLLABORATIVE PROJECT. T.J. Greenbowe and E.J. Pulliam, Chemistry Department, Southeastern Massachusetts University, N. Dartmouth, MA 02747.

For the past two years, the Massachusetts Board of Regents has funded a series of projects with the intent of haing university faculty work collaboratively with regional high school science and mathematics teachers to develop courses and workshops in their respective content areas. Working together, a steering committee designed a series of courses and an annual symposium for high school and middle school science and mathematics teachers. The symposiums have enjoyed and tremendous success and the courses have met with modest success. We will focus our discussion on the courses offered for chemistry teachers: chromatography, spectroscopy, and equilibria. The workshops and papers presented at the symposiums were unique enough to merit a comment in our discussion. We will share some of our experiences with implementing and sustaining this collaborative project in hopes that others will try similar projects between high schools and universities.

IP-03 COLLEGE FACULTY CAN INFLUENCE HIGH SCHOOL CHEMICAL EDUCATION -- AN UPDATE
John H. Bedenbaugh and Angela O. Bedenbaugh, Department of Chemistry, University of Southern Mississippi, Hattiesburg, MS 39406-8466

In 1984 we reported the beginning of a unique effort by the Mississippi Section of the ACS to improve the teaching of chemistry in Mississippi high schools. General chemistry teachers from every college and university in the state make up the active group, working together as members of the section's Education Committee.

During the last two years committee members have visited numerous high schools; addressed high school chemistry teachers at various meetings; established a common general chemistry placement test at all state colleges to help assess quality and needs of high school chemistry; obtained an NSF grant which funded the development, publication and state-wide distribution of a handbook for high school chemistry teachers. The handbook is a guidebook for the underprepared teacher as well as a sourcebook for all teachers.

Details of the next goal of the committee, a massive retraining program for all underprepared secondary school chemistry teachers in Mississippi, will be presented.

We think that the experiences of our committee can be useful to college faculty in other states who seek to improve high school chemistry in their localities.

IP-04 FEDERAL AND STATE SUPPORT FOR A SUMMER HIGH SCHOOL CHEMISTRY TEACHERS COURSE. William P. Jensen, South Dakota State University, Brookings, SD, 57007; William Clausen, Eagle Butte High School, Eagle Butte, SD, 57265; James Martin, Brookings High School, Brookings, SD, 57006; Terry Mehlbrech, Brandon Valley High School, Brandon, SD, 57005.

The Chemistry Department at SDSU had offered a graduate level chemistry course for high school chemistry teachers for three years during the month of June. This year's summer course (1986) is expanded considerably with the availability of Federal Title II funds and generous concessions at the State level.

This winter we were able to travel to high schools of the participants, plan for the summer course knowing who will enroll, and involve three high school teachers in the presentation of the course.

The four year development of the course will be discussed with emphasis on this summer's program. Twenty two limited stipends for participants were available and thirty people may enroll. The course is offered in the local high school using classroom equipment and laboratory facilities appropriate to the participants needs. Future developments including the creation of a Master of Science Teaching program will be discussed.

IP-05 INTENSIVE WORKSHOPS FOR JR. HIGH/HIGH SCHOOL TEACHERS. Joseph A. Marcello, Department of Chemistry, University of Idaho, Moscow, Idaho 83843

This presentation will detail the results of two intensive one-week workshops for jr. high/high school chemistry teachers. The workshops involve not only a detailed review of the basic chemical principles, but they also involve an in-depth discussion of the use of chemical demonstrations and real world examples in the classroom. The second workshop centers about the study of laboratory management and safety in the teaching laboratory. In addition, the workshop investigates the use of the inquiry method in the teaching laboratory. Both workshops provide for a great deal of hands-on experience for the teachers.

IP-06 THE DEVELOPMENT OF AN IN-SERVICE WORKSHOP PROGRAM FOR SECONDARY SCHOOL TEACHERS. R. Erdman, Venice HS; M. Glahn, Saugus HS; L. Soloff, and C. Williamson, J.F. Kennedy HS; CA

For five weeks during the Summer of 1983 twelve, high school, Chemistry teachers from Southern California participated in a UCLA-sponsored workshop. The outcomes of that project have far exceeded the goals and expectations of the participants. A local program to train teachers through in-service programs has grown into a national project. Under the auspices of the American Chemical Society and funded by the National Science Foundation a project to prepare materials for use in in-service workshops is progressing. This year, eight of the teachers have refined, rehearsed, and recorded 120 laboratory experiments and demonstrations. Transfer of the film to videodisc now allows complete flexibility in planning, scheduling, and teaching workshops. The first of these videodisc-based workshops will be given at the end of this conference.

IP-07 THE PERQUISITES OF PARTICIPATING. M. Freeman, Montebello HS; C. Grosse, El Dorado HS; B. Gonzalez, Bishop Montgomery HS; P. Noel, Etiwanda HS; CA

The twelve high school Chemistry teachers who participated in the 1983 UCLA Summer workshop gained much more than a better understanding of the university-high school interface. Active participation resulted in calibrating one's knowledge against that of peers and honing one's skills as a Chemistry teacher. Formal professional associations developed through membership in NSTA and CACT; informal associations developed through the new contacts made in the workshop. Participants gained new friends who can also be called compatriots and commiserators. Finally, the increased self-confidence of the participants has led to new career avenues. Teaching physics and calculus, advocating Chemistry to administrators, appointments as mentor teachers, and participating in the development of the ACS In-Service Workshop Program represent a few of the perquisites of the Summer of 1983

IP-08 INSTITUTE FOR HIGH SCHOOL CHEMISTRY TEACHERS AND THE BAY AREA CHEMISTRY TEACHERS PROJECT, Claire H. Smith, San Francisco University High School, 3065 Jackson Street., San Francisco, CA 94115.

The need for up-dating and improving the backgrounds of high school chemistry teachers was seriously neglected in the 1970's. To meet this need the Institute for High School Chemistry Teachers was initiated in 1983 in the San Francisco Bay Area. In the four years of its operation it has been the catalyst for a teachers' network, a newsletter, and many Saturday conferences. Because so many of the teachers had very little preparation in chemistry, an extensive in-service program was devised and then funded by the National Science Foundation. This presentatinn will give details of the summer Institute and the NSF project and discuss other ways of meeting the crisis of lack of qualified teachers of chemistry.

IP-09 INNOVATIVE PROGRAMS FOR THE IMPROVEMENT OF SCIENCE EDUCATION. William E. West, Science Chairman, Naperville Central High School, 440 W. Aurora Ave., Naperville, IL, 60566, and Lee R. Marek, Chemistry Instructor, Naperville North High School, Ogden Ave. at Mill St., Naperville, IL, 60566.

The Friends of Fermilab Association (FFLA) was founded in 1983 to develop pre-college education programs. Since then, programs develcped by the organization have touched the lives of science students and educators regionally, nationally, even internationally. FFLA sponsors or co-sponsors thirteen separate programs including: Summer Institute for Science Teachers; Physics West; Chemistry West; Illinois Research Corridor Summer Jobs Program for High School Science Teachers; Beauty and Charm at Fermilab; Problem Solving in Mathematics; Saturday Morning Physics at Fermilab; Target: Science and Engineering; Poster Contest-Discovery and Invention; Regional Videotape Library of Saturday Morning Physics; Resources for the Science Classroom; Conference on the Teaching of Modern Physics; and the Curriculum Design and Planning Workshop for the Illinois Mathematics and Science Academy. This session will describe these programs with a slide presentation. Handouts detailing the programs will be discussed.

Monday, July 28, 1986
Strategies and Ideas
275 Strand Union Building

8:00PM
Introduction
Session chair, **Parravano C**

8:05
IS-01
INQUIRY, SIMULATION AND THE LABORATORY IN TEACHING AND TESTING
Talesnick I

8:40
IS-02
A HIGH SCHOOL TEACHER'S 20 YEAR STRUGGLE WITH THERMODYNAMICS, OR HOW I GOT IN TROUBLE WITH THE LAWS
Cardulla F

8:55
IS-03
TEACHING THE LOGIC BEHIND THE ORGANIZATION OF DESCRIPTIVE CHEMISTRY
Fortman JJ

9:10
IS-04
RESEARCH, EDUCATIONAL AND SCIENTIFIC, IN THE PRECOLLEGE CLASSROOM
Schultz EL

9:25
IS-05
GROUP INVESTIGATION: AN ALTERNATIVE TO THE CONVENTIONAL LECTURE
Metz PA, Bodner GM

9:40
IS-06
A MODEL FOR CHEMICAL EDUCATION--A MASTER TEACHER LEADING AN INTERACTIVE CLASSROOM ACTIVITY
Sarquis AM, Kibbey BR

9:55
IS-07
GEMS, GAMES, AND BOOKS
Ealy Jr JL, **Bowen-Ealy J**

10:10
IS-08
PINTOS, GREYHOUNDS, APPLE TREES, PHILANTHROPISTS, AND TOILET PAPER--THE USE OF ANALOGY IN TEACHING CHEMISTRY
Coley WR

IS-01 INQUIRY, SIMULATION AND THE LABORATORY IN TEACHING AND TESTING

IRWIN TALESNICK - FACULTY OF EDUCATION, QUEEN'S UNIVERSITY,
KINGSTON, ONTARIO, CANADA K7L 3N6

Students' progress in chemistry must be evaluated with reference to the ways in which they were taught. Considerable lip service is given to the role of the laboratory in teaching. Little is said about how the students' laboratory inquiry and laboratory design skills are evaluated.

During this presentation a number of teaching and testing techniques will be described. The lecture will include some practical examples of the use of inquiry techniques to introduce problem solving skills in the classroom.

Examples of useful and useable laboratory evaluation materials will be distributed.

IS-02

A HIGH SCHOOL TEACHER'S 20 YEAR STRUGGLE WITH THERMODYNAMICS, OR HOW I GOT IN TROUBLE WITH THE LAWS , F. Cardulla, Niles North H. S., Skokie, IL., 60077

Thermodynamics can be a frustrating subject for many instructors, both in terms of learning and in terms of teaching. Like many of us, the author has struggled for his entire teaching career to both achieve some measure of literacy in this most elegant of subjects and to try and convey some of the excitement and beauty of thermodynamics to his students. In this session his experiences, mistakes, and small but hard-won insights will be shared with others who may have experienced or may be currently experiencing similar frustrations.

IS-03 TEACHING THE LOGIC BEHIND THE ORGANIZATION OF DESCRIPTIVE CHEMISTRY.

John J. Fortman, Dept. of Chemistry, Wright State University, Dayton, Ohio 45435

Since many students taking general chemistry may never directly use the chemistry taught, it is of value to make them aware of the processes of logical thinking which a course in chemistry is adding to their education. Organic reactions, solubilities, oxide formation, and heats of formation will be used to illustrate the use of such thinking processes as classification, generalization, modification, exception and combination, to minimize the number of items to be learned. For example, acid plus alcohol yielding ester plus water represents thousands of specific reactions.

IS-04 RESEARCH, EDUCATIONAL AND SCIENTIFIC, IN THE PRECOLLEGE CLASSROOM. E. L. Schultz, Marblehead High School, Marblehead, MA 01945.

The high school classroom is a laboratory ripe for a variety of experiments. Sharing theories of learning and teaching with students can lead to a variety of interesting contexts for educational research. While it is very difficult to maintain a viable control group, experienced teachers can appropriately set experimental conditions to test hypotheses. It is important to involve the administration of the school in order to obtain the support necessary to continue this activity.

Encouraging students to define simple research problems in chemistry, design and carry out the appropriate research in a legitimate fashion is often expedited if students have been involved in a teacher-generated research be it behavioral, teaching/learning or chemical.

IS-05 **GROUP INVESTIGATION: AN ALTERNATIVE TO THE CONVENTIONAL LECTURE. Patricia A. Metz and George M. Bodner. Department of Chemistry. Purdue University. West Lafayette, Indiana 47907.**

Recognizing and recalling terms, symbols and equations is not the goal of most college chemistry courses. Most of these courses hope to encourage students to integrate and apply chemical concepts and principles to novel situations. Under the current mode of instruction, students all too often fall short of this goal; not so much from a lack of ability or hard work, but from a lack of practice. Group investigation takes students beyond the level of memorization and recall by actively engaging them in the learning process during classroom instruction. Classroom time is devoted to developing higher thinking skills involving the application, analysis and integration of factual knowledge in order to solve problems, answer probing questions, and explain observed discrepancies and demonstrations. With this method of instruction the chemistry professor is no longer a disseminator of information but a facilitator of learning, and the student is no longer a passive receptor of information but an active constructor of knowledge. This paper will present preliminary findings of a study which compares group investigation to the classical lecture model of instruction in chemistry.

IS-06 A MODEL FOR CHEMICAL EDUCATION---A MASTER TEACHER LEADING AN INTERACTIVE CLASSROOM ACTIVITY. A. M. Sarquis, Dept. of Chemistry, Miami University-Middletown, Middletown, OH 45042.

Master teachers provide role models for all educators regardless of grade level. This video tape documents one such model of interactive, hands-on chemistry. A master fourth grade teacher leads her class through the preparation and investigation of the properties of Slime.

IS-07 GEMS, GAMES, AND BOOKS. James L. Ealy, Jr. and Julie Bowen-Ealy, The Hill School, Pottstown, PA 19464

The wealth of (re)discovered problem solving algorithms make the teaching of honors high school and Advanced Placement chemistry more interesting and challenging both to the student and teacher. Much of the emphasis of the presentation will be placed on problem solving methods, not necessarily chemistry problems. The use of problem solving games (Eskimos and igloos) as well as examples of ways in which many of the new books can be used to strengthen a chemistry presentation. The books include, The Dancing WU LI Masters, The Cosmic Code, The Tao of Physics, and many more. Many handouts will be included to help demonstrate this methodology.

IS-08

PINTOS, GREYHOUNDS, APPLE TREES, PHILANTHROPISTS, AND TOILET PAPER - THE USE OF ANALOGY IN TEACHING CHEMISTRY; W.Robert Coley; Montgomery College, Germantown Campus, Germantown, Maryland 20874.

Analogies have been used by chemists to explain concepts and to help in the visualization of the invisible, from Kekule's benzene "snakes", to the chair, boat, and bowsprit-flagpole analogies of cyclohexane, to J.D. Roberts' rhinoceros-dragon-unicorn analogy for resonance. The use of analogies in the classroom is still a powerful tool for this purpose, one which has the added benefits of demystifying chemistry and helping to break down student anxieties about it.

The presentation will focus on analogies used by the author in freshman and sophomore courses and will include among others, analogies for use in the discussion of covalent bonding, intermolecular forces, reaction kinetics, equilibrium, conjugate acid-base pair strength, concerted and non-concerted mechanisms in organic chemistry, and even enzymatic hydrolysis of starch.

Monday, July 28, 1986
Computer Hands-On I
276 Strand Union Building

8:00-10:30PM

CH-01
COMPUTER-ASSISTED VIDEODISC LESSONS IN CHEMISTRY
Smith SG, Jones LL

CH-02
A NEW WAY TO TEACH HIGH SCHOOL CHEMISTRY LABORATORY
Saltsburg H, Heist R, Olsen T

CH-03
THE COMPUTER AS A PROBLEM-SOLVING PARTNER--A PROGRAM WRITTEN IN PROLOG
Cabrol D, Cachet C, Cornelius R

CH-04
UNDERGRADUATE USE OF EQUATION SOLVERS FOR CHEMICAL COMPUTATIONS
Smith AL

CH-05
USING THREE COMPUTER ASSISTED INSTRUCTIONAL PROGRAMS IN TEACHING ORGANIC CHEMISTRY
Stierle DB, McBride DJ

CH-06
DYNAMIC COMPUTER PROGRAMMING: ALLOWING STUDENTS TO DESIGN AND SOLVE THEIR OWN PROBLEMS
Mottel EA

CH-07
TUTORIAL SOFTWARE FOR GENERAL CHEMISTRY
Dreyfuss RM

CH-08
SO, YOU ONLY HAVE ONE COMPUTER...
Bogner D

CH-01 COMPUTER-ASSISTED VIDEODISC LESSONS IN CHEMISTRY. Stanley G. Smith and Loretta L. Jones, School of Chemical Sciences, University of Illinois, 601 S. Mathews, Urbana, IL 61801

A series of interactive video disc lessons in general chemistry have been produced and evaluated in secondary school and college classrooms. The interactive tutorial lessons integrate computer graphics and text overlays with high quality video images of actual chemicals and their reactions. Most of the lessons consist of laboratory experiments which involve the students in hypothesizing, experimenting, collecting data, and analyzing data. The overlays help to focus students' attention on the interpretation of experimental results and encourage additional experimentation. Hardware used includes a Pioneer LD-V1000 laser video disc player controlled by an IBM personal computer using a Microkey overlay card produced by Video Associates Labs. The video images were recorded on a 3/4 inch videotape master, edited, then transferred to video disc.

CH-02 A NEW WAY TO TEACH HIGH SCHOOL CHEMISTRY LABORATORY. H. Saltsburg, R.H. Heist, and T. Olsen, Dept. of Chemical Engineering, Univ. of Rochester, Rochester, NY 14627.

Advancements in the high school chemistry laboratory have not kept pace with those in chemistry textbooks. As a result, it has become difficult to reinforce the quantitative aspects of chemistry stressed in the classroom with quantitative laboratory experiments. What is needed is a modern laboratory technology which does for laboratory studies what the word processor does for writers. CHEMPAC, a complete high school chemistry laboratory program, provides this approach. It is computer based (no simulations) and provides students with modern data acquisition and data logging capabilities. Each CHEMPAC workstation includes, among other items, a variety of sensors (temperature, pressure, pH and EMF), a colorimeter and complete software for the experiments. The laboratory manual is coordinated with the software. A detailed description of CHEMPAC, its capabilities and objectives will be given. Sample data from selected experiments will be illustrated and actual experiments will be demonstrated.

CH-03 THE COMPUTER AS A PROBLEM-SOLVING PARTNER--A PROGRAM WRITTEN IN PROLOG. Daniel Cabrol and Claude Cachet, Universite de Nice, 06034 Nice, France; Richard Cornelius, Lebanon Valley College, Annville, PA 17003.

The idea of a "Problem-Solving Partner" lies outside of the typical approach used in CAI. Instead of a student responding to questions posed by a program, the program responds to questions asked by the student. Such a program must solve and explain the solution for problems not defined in advance by the software author; it must use a heuristic approach rather than a purely algorithmic one as it seeks a solution.

The first program written on this basis (GEORGE) can solve a large number of problems, such as those found in preparing solutions, dilution, mixing, and titration. It works with the fundamental quantities mass, volume, and number of moles, as well as with derived quantities such as density and molarity. Within the program the relations between these quantities are determined by dimensional analysis.

An expansion of the domain of application requires that relations among quantities not be limited by dimensional analysis. We have used the language PROLOG to create a program that extends the domain of the first program to include gas-law problems. The search for a solution may be carried out through either forward or backward chaining.

CH-04 UNDERGRADUATE USE OF EQUATION SOLVERS FOR CHEMICAL COMPUTATIONS. Allen L. Smith, Chemistry Department, Drexel University, Philadelphia, PA 19104

As personal computers become commonplace, computational environments available to students of chemistry should improve markedly over what is provided by the hand-held calculator. Having all students learn BASIC (or FORTRAN or Pascal, for that matter) is not the answer, since too much time is wasted on such as formatting, structured procedural flow, and computational algorithms, tasks irrelevant to chemical problem-solving. Only a small fraction of chemists will ever write a program in a high-level language. New types of computational software are available which make the numerical aspects of problem-solving in chemistry far easier than with the traditional combination of algebra and hand-held calculators. A rule-based, declarative programming language for scientific equation solving (A. L. Smith, Artificial Intelligence Applications in Chemistry, ACS Symposium Series, Ch. 9 (1986)) has been used extensively with physical chemistry students learning chemical equilibrium, chemical kinetics, spectroscopy, quantum theory, and data analysis both in the lecture and the lab. It is also widely used in chemical engineering courses. Examples of student use and results of student surveys will be presented. Equation solvers will be contrasted with spreadsheets and BASIC as examples of suitable computational environments.

CH-05 USING THREE COMPUTER ASSISTED INSTRUCTIONAL PROGRAMS IN TEACHING ORGANIC CHEMISTRY, Donald B. Stierle; Donald J. McBride; Department of Chemistry and Geochemistry, Montana College of Mineral Science and Technology, West Park Street, Butte, MT 59701. Computers play big roles in many aspects of chemistry and can help in the instruction of organic chemistry. Three programs have been written to drill students on organic nomenclature, organic reactions and organic synthesis. These programs are used on conjunction with a conventional organic textbook to help students practice these areas of organic. The programs will be demonstrated in this presentation.

CH-06 DYNAMIC COMPUTER PROGRAMMING: ALLOWING STUDENTS TO DESIGN AND SOLVE THEIR OWN PROBLEMS.

Edward A. Mottel, Department of Chemistry, Rose-Hulman Institute of Technology, Terre Haute, IN 47803-3999

Problem sets are probably one of the best means of solidifying and applying chemical principles that are quantitative in nature. Various techniques have been used to accomplish this including giving each student the same problem set and using a computer to assign random numeric values to the same problem for each student. Dynamic programming allows students to select their own values for parameters and then solve the problem. The advantages of this approach include individualized problems (no two students should independently choose the same set of parameters) and a de-emphasis on copying another student's work.

The program can be used as a "black box", giving the answer to the problem or in a "quiz mode" in which the student provides both the initial parameters and final result. The program then determines whether the result is correct or incorrect.

One such dynamic program we have developed involves the adiabatic mixing of ice, water and steam. The program is written in BASIC and is suitable for any make or model of microcomputer.

CH-07

TUTORIAL SOFTWARE FOR GENERAL CHEMISTRY.

Robert M. Dreyfuss, Mercy College, Dobbs Ferry, New York 10522

Since September 1983, these programs have been available for student use on Apple II computers in the college library. Most of the programs will pose a randomly-generated (not randomly-selected) problem; the student then has the choice of going directly to the answer or having the computer give a step-by-step solution. At that point, the student is given the choice of going through the identical problem, going through a problem with all conditions and chemicals changed or returning to the menu of problems available on the disks. Usually, students willing to try one of the programs will return to use the entire set. They have access, therefore, to hundreds more solved problems than can be shown in a textbook.

CH-08 SO, YOU ONLY HAVE ONE COMPUTER...

Dr. Donna Bogner, Box 51, Wichita State Univ., Wichita, KS 67208.

Microcomputers are not textbooks or lab manuals; you do not need one for each student. This presentation will demonstrate the use of ONE computer as a lecture aide, a demonstration tool, and as a data-collection device using free and inexpensive software, to help students visualize abstract concepts, concentrate on the results of changing parameters, and collect quantitative data in the classroom setting.

Free and inexpensive software that can be used to introduce and/or amplify the concepts of moles, random occurences, atomic structure and size of atoms and ions, changing gas law and reaction rate parameters. Handout materials will contain background information and documentation for use of the software.

Monday, July 28, 1986
Chemistry for Kids II
Strand Union Ballroom - D

8:00PM
Introduction
Session chair, **Steiner R**

8:05
KC-03
IMPROVING ELEMENTARY STUDENTS' VISUAL PROBLEM SOLVING SKILLS
Bowen CW, Suarez CA, Hamm V,

8:20
KC-04
A MULTILEVEL APPROACH TO K-3 SCIENCE TEACHING
Redden PA

8:35
KC-05
"CHEMISTRY CAN BE FUN": AN I.C.E. ACTIVITY FOR MIDDLE SCHOOL STUDENTS
Jeurgens FH, Perkins RI, Gelder JI, Shaw DB, Spencer KM

8:40
KC-06
CHEMISTRY CAN BE FUN
Danieley JE

8:45
KC-07
HOUSEHOLD CHEMISTRY FOR KIDS 6-15
Bridges B, Wilcox V,

8:50
KC-08
CHEMISTRY—A DISCOVERY SCIENCE
Sarquis AM, Smyth E

8:55
KC-09
REPORT FROM THE DivCHED TASK FORCE ON PRE-HIGH SCHOOL SCIENCE
Steiner R, Switzer T

9:25
Discussion

KC-03 IMPROVING ELEMENTARY STUDENTS' VISUAL PROBLEM SOLVING SKILLS. Craig W. Bowen, Cristina A. Suarez and Virginia Hamm, Department of Chemistry, Purdue University, West Lafayette, Indiana 47907

Fourth and fifth grade gifted students in Indianapolis participate at the Indiana State Museum in a program about inventions. The program is divided into three sections. First, the students learn about the theory of plate tectonics which illustrates the idea that theories are inventions. Next, the student observe a Foucault Pendulum which demonstrates how an experiment can be regarded as an invention. Finally the students participate in some exercises to improve the visual thinking skills which they can utilize in the inventing process.

The students participate in four exercises during a 75-minute period. One half of the students work on making different figures with Tangrams while the other half builds three dimensional figures with sugar cubes. After all the students perform both exercises, they work on push-rod box and rolling can exercises. In these activities the students are shown actual inventions and asked to draw a possible design for the invention. The final activity is the combine and conquer exercises in which the students are given three common objects and asked to come up with an invention.

KC-04

A MULTI-LEVEL APPROACH TO K-3 SCIENCE TEACHING, Patricia A. Redden, Chemistry Department, Saint Peter's College, Jersey City, NJ 07306

How can we help elementary school teachers with minimal science background to feel comfortable with science teaching? Saint Peter's College used a cooperative plan involving college science faculty, education faculty from the college, elementary school (K-3) teachers, and undergraduate science majors. The experienced primary school teachers were paired with undergraduates who have a science background but are not trained as teachers. The undergraduates met weekly with their paired class, carrying out demonstrations and experiments which were followed through by the participating teachers. Meanwhile, the teachers attended seminars to improve their knowledge of science. The program was funded by a grant from the New Jersey Department of Higher Education.

KC-05 "CHEMISTRY CAN BE FUN": AN I.C.E. ACTIVITY FOR MIDDLE SCHOOL STUDENTS. Jeurgens FH, Perkins RI, Gelder JI, Shaw DB, Spencer KM.

This is a 5-minute introduction to the program which will be demonstrated Wednesday afternoon in "Kids Chemistry in Action (IV)". See abstract # KA-05.

KC-06 CHEMISTRY CAN BE FUN. Daniely JE.

This is a 5-minute introduction to the program which will be demonstrated Tuesday afternoon in "Kids Chemistry in Action (II)". See abstract # KA-02.

KC-07 HOUSEHOLD CHEMISTRY FOR KIDS 6-15. Bridges B., Wilcox V.

This is a 5-minute introduction to the program which will be demonstrated Wednesday morning in "Kids Chemistry in Action (III)". See abstract # KA-03.

KC-08 CHEMISTRY-A DISCOVERY SCIENCE. Sarquis AM, Smyth E.

This is a 5-minute introduction to the program which will be demonstrated Wednesday morning in "Kids Chemistry in Action (III)". See abstract # KA-04 .

KC-09 REPORT FROM THE DIVCHED TASK FORCE ON PRE-HIGH SCHOOL SCIENCE.
Richard Steiner, Department of Chemistry, University of Utah,
Salt Lake City, Utah 84112

The Task Force was commissioned to interface with the office of Pre-High School Chemistry established by the ACS. We are attempting to create a network of people working in the field, to make a bibliography of available materials and to suggest topics around which a K-6 curriculum can be built. Progress in these areas will be presented.

Tuesday, July 29, 1986
Microscale Organic Laboratory
Strand Union Balloom - D

9:00AM
Session Chair, **Mayo DW**

9:05AM
MC-01
FRACTIONAL DIST. AT THE SEMI-MICROSCALE LEVEL: A NOVEL SPINNING-BAND COLUMN
Mayo DW, Butcher SS, Hinkle RJ, **Pike RM**

9:30
MC-02
DEVELOPMENT OF MULTISTEP SYNTHESES FOR THE MICROSCALE ORGANIC LABORATORY
Danishefsky S, Kempin S, Kummer M

9:55
MC-03
MICROSCALE ORGANIC QUALITATIVE ANALYSIS: A ONE QUARTER LABORATORY COURSE
Craig RER

10:20
MC-04
SOME MILLIMOLE SCALE ORGANIC EXPERIMENTS
Todd D

10:45
MC-05
SMALL SCALE ORGANIC EXPERIMENTS - APPARATUS AND TECHNIQUES
Williamson KL

11:10
MC-06
MICROSCALE SYNTHESIS OF cis-NORBORNENE-5,6-endo-DICARBOXYLIC ANHYDRIDE AND ITS DERIVATIVES
Griffin W, Nothman A, **Weill III DR**

11:35
MC-07
THE MICROSCALE LABORATORY AT BROWN UNIVERSITY
Lawler RG, Parker KA, **Semple TC**, Squillacote ME

MC-01 FRACTIONAL DISTILLATION AT THE SEMI-MICROSCALE LEVEL: A NOVEL SPINNING-BAND COLUMN. Dana W. Mayo, Samuel S. Butcher, Robert J. Hinkle, Department of Chemistry, Bowdoin College, Brunswick, Maine 04011 and Ronald M. Pike, Department of Chemistry, Merrimack College, North Andover, Massachusetts 01845.

Efficient separation of liquid mixtures in the range of 250 μL to 3 mL presently requires the useof either preparative gas chromatographic instrumentation or sophisticated and expensive fractional distillation equipment. This paper will discuss the design and performance of a novel low cost spinning-band fractionation column. Operational data demonstrate that rapid and effective resolution of simple close boiling mixtures in the undergraduate instructional laboratory can now be achieved. With minor modification of the instructional apparatus performance of the system approaches that required for use in graduate and industrial research laboratories.

MC-02 DEVELOPMENT OF MULTISTEP SYNTHESES FOR THE MICROSCALE ORGANIC LABORATORY, S. Danishefsky, S. Kempin and M. Kummer, Dept. of Chemistry, Yale University, New Haven, CT 06511.

Short multi-step syntheses leading to a reasonably sophisticated molecule will be presented. These sequential preparations which start at the gram level and end-up on a milligram scale seem ideally suited for our purpose of developing chemists who can work on any scale.

MC-03 MICROSCALE ORGANIC QUALITATIVE ANALYSIS: A ONE QUARTER LABORATORY COURSE
R.E.R.Craig, Department of Chemistry, Kalamazoo College, Kalamazoo, Michigan 49007

The laboratory involves identification of two simple unknowns and the separation and identification of two three-component mixtures. The two simple unknowns, consisting of a liquid and a solid, are identified on the basis of standard solubility and chemical classification tests, physical property determination and spectroscopic(IR/NMR) information.The first three-component mixture comprised of acid/base/neutral components may be separated by chemical extraction. The three components consist of a high boiling liquid (>200°C), a low melting solid and a high melting solid. The acid is selected from either the carboxylic acid or phenol category while the base may be a 1°, 2° or 3° amine. The neutral compound may be an alcohol, ether, aldehyde, ketone, ester, hydrocarbon, alkyl halide etc. The second three-component mixture contains only neutral components with sufficient polarity difference to allow separation by flash chromatography or gas chromatography. Students are encouraged to use TLC and visualization techniques extensively. Lists of typical three-component mixtures and supplemental material to "Microscale Organic Laboratory" by Mayo, Pike and Butcher for additional identification tests, visualization techniques for TLC and physical measurements will be provided.

MC-04 SOME MILLIMOLE SCALE ORGANIC EXPERIMENTS. D. Todd, Department of Chemistry, WPI, Worcester, MA 01609

At WPI an effort is being made to convert to the millimole scale (MMS) level a number of organic preparations known to go well at the macro level.

These include: the monobenzoylation of benzene-1,2-diol, followed by mononitration of the product and isolation of the two nitration products; the Friedel-Crafts acetylation of bromobenzene; the F-C succinoylation of anisole; the Vorlander rearrangement of benzilic acid to fluorene-9-carboxylic acid; a Cope rearrangement starting with salicylaldehyde, benzil and ammonia; a Diels-Alder reaction of α-phellandrene; an aromatic nucleophilic competition experiment (on a 0.1 MMS).

These experiments-and others-are carried out with 4-inch test tubes, Pasteur pipets and 10-mL Erlenmeyers as the basic tools. No ground glass equipment is needed.

The message will be: get started now on MMS lab work, using a mix of MMS and macroscale, without the need to spend money on special equipment.

MC-05 SMALL SCALE ORGANIC EXPERIMENTS - APPARATUS AND TECHNIQUES. Kenneth L. Williamson, Department of Chemistry, Mount Holyoke College, South Hadley, MA 01075.

Organic experiments can be scaled down in a number of ways. In one approach equipment and techniques are simply miniaturized versions of larger scale experiments, complete with stirrers, reflux condensers, dropping funnels, etc. We have been exploring an alternative approach in which experiments are carried out with very simple equipment. In order to use this equipment and teach small scale techniques, we make use of extreme close-up video tapes. These video tapes will be part of our presentation.

MC-06 MICROSCALE SYNTHESIS OF cis-NORBORNENE-5,6-endo-DICARBOXYLIC ANHYDRIDE AND ITS DERIVATIVES, William Griffin, Andrew Nothman, David R. Weill III, Department of Science, Shady Side Academy, 423 Fox Chapel Road, Pittsburgh, PA 15238, U.S.A.

This paper will describe our present experiment in the Diels-Alder synthesis of two Norbornene diacid anhydrides and their derivatives. The experiment allows students to study the cycloaddition reaction and two types of reaction control: kinetic and thermodynamic. The experiment presents a symmetry controlled mechanism that is a good introduction to electrophilic addition or aromatic substitution reactions.

The experiment is performed rapidly at the microscale level using very simple apparatus and small quantities of reagents. Stereochemical considerations, symmetry implications, structural determinations, and ideas for further research will be presented.

MC-07 THE MICROSCALE LABORATORY AT BROWN UNIVERSITY. R. G. Lawler, K. A. Parker, T. C. Semple, and M. E. Squillacote, Department of Chemistry, Brown University, Providence, RI 02912.

We will discuss our efforts at Brown to establish a microscale laboratory course for first semester organic chemistry. The course is based upon the use of very simple glassware which allows us to concentrate on the technique being applied. At the same time the safety, speed and efficiency of microscale work is maintained. We have expanded our efforts this Spring to a class of 90 students.

Tuesday, July 29, 1986
Learning Theory Applied
Strand Union Ballroom - C

9:00AM
Introduction
Session Chair, **Hovland AK**

9:05
LT-01
EDUCATIONAL RESEARCH VIA CHEMISTRY EXAMS
Grotz, LC

9:25
LT-02
SPATIAL ABILITY AND PROBLEM SOLVING IN CHEMISTRY
Bodner GM, McMillen TLB, Carter CS, Pribyl JR, LaRussa MA

9:45
LT-03
DIFFERENCES BEWTEEN THE PROBLEM SOLVING PROCESSES OF "HIGH" AND "LOW" SPATIAL ABILITY STUDENTS
Pribyl JR, Bodner GM

10:05
LT-04
TEACHING PROBLEM SOLVING ACCORDING TO A COGNITIVE PYSCHOLOGY MODEL
Bunce DM

10:25
LT-05
WHOLE BRAIN RESEARCH AND IMPLICATIONS FOR CHEMISTRY TEACHING
Whyte BM

10:45
LT-06
THE CONSTRUCTIVIST THEORY OF KNOWLEDGE
Bodner GM

11:05
LT-07
EVIDENCE FOR THE CONSTRUCTIVIST THEORY OF KNOWLEDGE, THE ROLE OF MISCONCEPTS IN LEARNING, AND IMPLICATIONS OF THE CONSTRUCTIVIST MODEL FOR TEACHING
Bodner GM

11:25
Discussion

LT-01 EDUCATIONAL RESEARCH VIA CHEMISTRY EXAMS. Leonard C. Grotz, University of Wisconsin, Waukesha County Center, 1500 University Dr., Waukesha, WI 53188.

The usual function of chemistry exams is to ascertain the degree of mastery of chemistry by the students. However, with the expenditure of a little time and effort, these same examinations can be turned into a "gold mine" of data for research into the difficulties encountered in teaching and learning chemistry. By proper test preparation and by an analysis of the student results, the exams can be used to gain insights into the difficulties that students have with chemistry, and to relate the difficulties to the level of cognitive development of the students and to their deficiencies in taking examinations and in preparing for them. These procedures are believed to be a valid probing of the minds of the students to determine why they cannot learn chemistry. Gaining greater insight into the problems of the students enables one to do a better job of teaching chemistry. The results obtained to date will be presented and discussed.

LT-02 SPATIAL ABILITY AND PROBLEM SOLVING IN CHEMISTRY. George M. Bodner, Theresa L. B. McMillen, Carolyn S. Carter, Jeffrey R. Pribyl and Mary A. LaRussa, Department of Chemistry, Purdue University, West Lafayette, IN 47907.

We were originally attracted to studying the relationship between spatial ability and success in chemistry by the hypothesis that chemists routinely perform highly spatial tasks such as mentally rotating three-dimensional representations of molecules. We soon found, however, that spatial ability also correlated with performance on non-spatial tasks in chemistry such as answering multiple choice stoichiometry questions. In this paper we will summarize the results of studies of more than 4,000 students enrolled in various general and organic chemistry courses which suggest that spatial ability correlates with performance in chemistry whenever the tasks falls into the broad category of problem solving, but not when the task can be solved by rote memory or by the application of routine algorithms. We will then present a model of problem solving which is consistent with these results.

LT-03 DIFFERENCES BETWEEN THE PROBLEM SOLVING PROCESSES OF "HIGH" AND "LOW" SPATIAL ABILITY STUDENTS. Jeffrey R. Pribyl and George M. Bodner, Department of Chemistry, Purdue University, West Lafayette, Indiana 47907.

Previous work by Carter, LaRussa, and Bodner and Pribyl and Bodner has suggested that spatial ability was an important factor in problem solving in both general and organic chemistry. Bodner and McMillen have proposed a hypothesis for explaining this phenomenon which argues that spatial ability to some extent measures the ability to structure or restructure information in the cognitive domain, and a similar process is involved in one of the early stages of problem solving. In this study, 30 students (equally divided between those classified as "high" spatial ability and those classified as "low" spatial ability) were interviewed using the think-aloud technique as they solved four stoichiometry problems. The results of these interviews will be discussed in terms of what they tell us about the importance of restructuring information in problem solving.

LT-04 TEACHING PROBLEM SOLVING ACCORDING TO A COGNITIVE PSYCHOLOGY MODEL.

Diane M. Diane M. Bunce, Catholic University of America, Chemistry Department, Washington, D. C. 20064

Students enrolled in a general chemistry course for the health sciences were taught problem solving according to a method developed by the researcher. This method is based upon the differences reported between expert and novice problem solving strategies. Although the entire class was taught problem solving using this method, only a randomly selected group was required to use it on a take-home stoichiometry examination. The other group could use the method if they chose. Differences in achievement between these two groups together with differences in achievement between students in either group who used the method vs. those who did not were compared on a test immediately following the take-home examination and on stoichiometry problems given on tests one week, three weeks and eight weeks later. No significant differences were found in the achievement of the group required to use the method on the take-home examination and the group that could use it if they chose. Significant differences were found on some tests between students who did use the method whether they were required to use it on the take-home examination or not and those students who did not use it.

LT-05 WHOLE BRAIN RESEARCH AND IMPLICATIONS FOR CHEMISTRY TEACHING.

Helena M. Whyte, Los Alamos National Laboratory, PA-15, MS M589, Los Alamos, NM 87545.

During the last two decades, new understandings of brain function have established a differentiated role of the two brain hemispheres. Academic success seems to be influenced by the individual's dominant hemisphere usage. The format of today's schools is directed primarily to the left hemisphere. Industry is asking for graduates who can read, write, communicate, and think. Holistic problem solving (the ability to think) is a function of the right brain which is neglected past the primary grades in today's educational system. In my paper I will discuss techniques to make Chemistry Teaching a whole brain activity. Teaching chemistry as a whole brain activity will enhance learning and make students more creative. I will briefly review the literature and will discuss neurological theories that higher levels of thinking and creative ideas require linkage between both brain hemispheres and cannot be accomplished utilizing one side of the brain alone. The techniques I will describe are easily implemented and are not time consuming; whole brain learning can be accomplished without sacrificing the syllabus.

LT-06 THE CONSTRUCTIVIST THEORY OF KNOWLEDGE.

George M. Bodner, Department of Chemistry, Purdue University, West Lafayette, Indiana 47907

The constructivist model can be summarized in a single statement: Knowledge is constructed in the mind of the learner. Constructivists argue that: (1) teaching and learning are not synonymous; we can teach, and teach well, without having the students learn, (2) knowledge is seldom transferred intact from the mind of the teacher to the mind of the student, (3) knowledge is constructed in the mind of the learner, (4) active students learn more than passive students, (5) no one learns more than the person teaching a course for the first time, and (6) the best way to organize information after it is understood is not always the best way to organize it so it will be understood in the first place. In this paper we will contrast the constructivist theory of knowledge to the traditional or "realist" model which shapes traditional views of instruction. We will show how the constructivist model builds on the foundation of Piaget's theory of intellectual development, and helps us better understand some of the points that Piaget tried to make.

LT-07 EVIDENCE FOR THE CONSTRUCTIVIST THEORY OF KNOWLEDGE, THE ROLE OF MISCONCEPTS IN LEARNING, AND IMPLICATIONS OF THE CONSTRUCTIVIST MODEL FOR TEACHING. George M. Bodner, Department of Chemistry, Purdue University, West Lafayette, Indiana 47907.

For the sake of argument, we will define concepts as ideas, theories or models; preconcepts as mistaken ideas that students bring to our classes which are easily removed through instruction; and misconcepts as mistaken ideas or concepts that have been found to be remarkably resistant to instruction. As an example of a misconcept, we might note that Kaput and Clements found that 25-30% of freshman engineering students had difficulty translating the following sentence into an equation: "There are six times as many students as professors at this university." The most common wrong answer was: "6S = P". Rosnick found that 22% of the students who had successfully completed a year of calculus chose the "absurd" answer that S stands for professor when asked the question: "At this university, there are six times as many students as professors. This fact is represented by the equation S = 6P. What does the letter S stand for?" Lochhead found that a third of the college faculty and half of the high school teachers given the same task made similar errors. The constructivist theory of knowledge provides us with the basis for understanding why this misconcept is so persistent, and it also has important implications for how chemistry should be taught in the future.

Tuesday, July 29, 1986
Writing Across the Curriculum-II
Strand Union Ballroom - B

9:00AM
Introduction
Session Chair, **Anderson CP**

9:05
RT-06
ORGANIZING A MULTI-SECTION LABORATORY TO SUPPORT WRITING ACROSS THE CURRICULUM
Lewis DI

9:25
RT-07
TEACHING TECHNICAL COMMUNICATIONS
Anderson CP

9:45
RT-08
PLANNING A WRITING ASSIGNMENT FOR AN ADVANCED CHEMISTRY COURSE
White BE, **White JE**

10:05
RT-09
WRITING ACROSS THE CURRICULUM: CHEMISTRY FOR NON-SCIENCE MAJORS
Bausser JW

10:25
RT-10
SELECTED MAGAZINE ARTICLES AS THE BASIS FOR BRIEF ESSAY ASSIGNMENTS IN GENERAL CHEMISTRY
Drake RF

10:45
RT-11
THE ROLE OF READING AND WRITING IN TEACHING CHEMISTRY
Baker CA, Zetzl M

11:05
RT-12
BEYOND "FILL-IN-THE-BLANKS": WRITING FOR THE FIRST YEAR CHEMISTRY LABORATORY
Conrad JR

11:25
RT-13
SCIENCE WRITING WITH PUBLICATION IN MIND
Cinaglia MB

11:45
Discussion

RT-06 ORGANIZING A MULTI-SECTION LABORATORY TO SUPPORT WRITING ACROSS THE CURRICULUM. Doris I. Lewis, Department of Chemistry, Suffolk University, Boston, MA 02114

At Suffolk University the teaching staff of a chemistry laboratory course held regular discussion meetings over the course of the academic year with the objective of applying the principles of writing across the curriculum to the laboratory writing experience.

The end product in course design was not a radically new laboratory course, but one which featured traditional writing assignments in the form of a laboratory notebook and formal laboratory reports. Laboratory assignments were revised with an eye to clarity, especially with regard to the objectives and significance of the experiment. The laboratory report gained new emphasis in the course as a way of enhancing as well as demonstrating understanding of principles. A laboratory notebook replaced abbreviated data sheets. The discussion sessions proved valuable in providing support and training for the teaching staff. Overall, course organization and staff preparation were significantly improved by the project.

RT-07 TEACHING TECHNICAL COMMUNICATIONS, C.P. Anderson, University of Connecticut at Avery Point, Groton, Connecticut 06340

Chemistry students need to communicate the ideas they develop in the laboratory to others. Technical communication is stylistically different from writing for a general audience, but it still uses fundamental writing and speaking skills. The science teacher can stress reporting material so that it is factual, clear, complete, and unambiguous as possible. But the chemist alone cannot teach the total subject of communication. They need help from their colleagues. A librarian can easily teach not only the mechanics of researching a subject, but also the advantages of on-line searching. If this lesson is coupled with a trip to an industrial library the need for library skills is apparent. An English teacher's comments can help a student polish a dull report into an enjoyable reading experience. A draftsman's skill can make a student's draft into a professional manuscript. Other professionals can add other aspects to a chemist's learning to communicate.

RT-08 PLANNING A WRITING ASSIGNMENT FOR AN ADVANCED CHEMISTRY COURSE. B.E. White, Business School, Washington University, St. Louis, MO 63130, and J.E. White, Department of Chemistry, Southern Illinois University at Edwardsville, Edwardsville, IL 62026-1652.

A simulated conversation based on an actual taped conversation between a professor of chemistry and a professor of communications illustrates many points which should be considered when one plans a writing assignment for an advanced chemistry course. After the conversation demonstrates collaborative design of writing "across-the-curriculum", the communications professor discusses what theory and research in composition suggest makes for good writing assignments. The chemistry professor describes the assignment that resulted from this collaboration and discusses his evaluation of how well the assignment met its objectives.

RT-09 WRITING ACROSS THE CURRICULUM: CHEMISTRY FOR NON-SCIENCE MAJORS

Jack W. Hausser, Department of Chemistry, Duquesne University, Pittsburgh, PA 15282.

As a part of a College-wide effort to improve student writing skills, the introductory non-science major course in chemistry was one of eighteen discipline-oriented courses offered as writing courses. The chemistry course introduced students to the basic principles of chemistry in the first half of the semester and then focused on topics such as the chemical industry, environmental chemistry, energy and consumer chemistry in the second half. Five writing assignments stressing a variety of writing styles were required, and students were encouraged to keep a written log of current events related to chemistry.

Strategies using writing assignments to give the students a better understanding of chemistry, to involve students more with chemistry and to improve their writing skills will be discussed.

RT-10 SELECTED MAGAZINE ARTICLES AS THE BASIS FOR BRIEF ESSAY ASSIGNMENTS IN GENERAL CHEMISTRY.

Robert F. Drake, Department of Chemistry, Saint Mary's College, Winona, Minnesota 55987.

There is a concern that students, particularly science students, do not write well, and that they do not use an expanded vocabulary, particularly scientific terms. This paper will discuss the use of general interest chemistry and science articles, written at an appropriate level, from monthly magazines and newspapers, as the basis for brief but effective directed writing assignments in general chemistry. Examples will be cited and discussed.

RT-11 THE ROLE OF READING AND WRITING IN TEACHING CHEMISTRY.

Claire A. Baker and Martha Zetzl. Butler University, College of Education, Indianapolis, Indiana 46208.

In science the student receives a textbook and the teacher proceeds to explain what is in the text. At the end of the course the translator of the text is no longer available. The student cannot pursue the subject on his or her own.

Every teacher is a reading and writing teacher. Students should be specifically taught to read a science book with comprehension. Reading with understanding involves more than merely decoding of symbols. Words should bring to mind abstract attributes and relationships. An effective method of teaching reading starts with writing. Writing facilitates development of abstract ideas and relationships.

The speaker will present suggestions from reading research and methodology for teaching reading and writing to chemistry students. An open discussion of techniques used by other chemistry teachers is encouraged.

RT-12 BEYOND "FILL-IN-THE-BLANKS": WRITING FOR FIRST YEAR CHEMISTRY LABORATORY.

Joseph R. Conrad; Chemistry Dept., University of Wisconsin-River Falls, River Falls WI 54022

A major objective of first year laboratory is for the student to learn to describe chemical phenomena and to express conclusions based on manipulations and observations of chemical systems. Yet the parallel objective of quantitation of chemical principles dominates laboratory manuals and leads to the "Fill-in-the-Blanks" (FITB) style report sheet.

This project promotes writing, yet retains the grading efficiencies of the FITB format. A five minute period of expressive writing by the students and the instructor at the end of each laboratory period is used. Topics are chosen to relate to (1) some aspect of the day's work (2) experiences with chemistry outside the classroom (3) different elements of writing style or methods. Some exercises build directly toward the writing of two or three "open format" reports each term. Rewriting, in response to positive critique by peers or instructor is essential. Critique centers on basic logic and structure rather than mechanics. Among benefits are increased student confidence, interest, and abilities in writing and expanded student/instructor communication.

RT-13 SCIENCE WRITING WITH PUBLICATION IN MIND, Marianne B. Cinaglia, 2204 Hillside Road, Wilmington, DE 19810.

Although preparing lab reports presents an excellent opportunity for students to improve writing skills, writing for publication provides a more exciting opportunity for combining creativity and varied interests in written expression.

Stimulus for preparing articles may be winning essay contests sponsored by outside organizations or the publication of articles in a school magazine.

The author has presented the NFA workshop "Writing in the Content Areas to Delaware Teachers for Inservice Credit".

Tuesday, July 29, 1986
Teaching Assistants II
275 Strand Union Building

Session Chair, **Schuh MD**

9:00AM
TA-06
INTERDISCIPLINARY TA TRAINING
White JE

9:20
TA-07
THE TRAINING OF CHEMISTRY TEACHING ASSISTANTS- AN ISRAELI APPROACH
Ben-Zvi N

9:40
TA-08
LEARNING AND TEACHING THE NEW TA
Kerner NJK

10:00
TA-09
THE TEACHING FELLOW QUANDARY
Samuel PL

10:20
TA-10
TEACHING ENHANCEMENT TECHNIQUES FOR THE CHEMISTRY GRADUATE T.A.
Bishop MB, Bishop CB

10:40
TA-11
A PRACTICAL TA SCHOOL IN 1.5 DAYS
Kirschner S

11:00
TA-12
TRAINING AND EVALUATION OF TEACHING ASSISTANTS
Loeschen RL

11:20
Discussion

TA-06 INTERDISCIPLINARY TA TRAINING. J.E. White, Department of Chemistry, Southern Illinois University at Edwardsville, Edwardsville, IL 62026-1652

In Fall '85, our annual training program for teaching assistants was expanded to include TA's from biology as well as from chemistry. In the week before classes began, an intensive program included the TEACH modules, demonstration of use of fire extinguishers, presentations by professors of education, biology, and physics, and videotaping of microteaching. During the quarter, there were weekly meetings and a mid-term evaluation of the TA's by their classes. In spite of the weighting of the presentations toward chemistry, the biology TA's stated that they found the program useful.

TA-07 THE TRAINING OF CHEMISTRY TEACHING ASSISTANTS-AN ISRAELI APPROACH

Nava Ben Zvi, Science Teaching Department, The Hebrew University, Jerusalem, Israel.

Israeli teaching assistants play an important roll in the process of teaching tertiary level students chemical concepts, experimentations and problem solving. Though their background in chemistry is quite solid they lack formal background in education-theory and application.

Through a one semester workshop teaching assistants are exposed to a variety of elements, some of which are unique to tertiary level teaching, of science education. Their attitudes, preferences, classroom and laboratory performances are evaluated.

TA-08 LEARNING AND TEACHING AND THE NEW TA;

Nancy J. Konigsberg Kerner, Department of chemistry, The University of Michigan.

TAs are often unaware of their own learning style and the diversity of learning modes (i.e. kinesthetic, visual, symbolic, auditory...) of students. The new TA may also be unaware of the fact that student ability to think and deal with abstract chemical concepts will vary. This paper will discuss that portion of the TA training program at The University of Michigan which is devoted to increasing TAs awareness of learning processes and how to use knowledge of learning to improve teaching.

TA-09 THE TEACHING FELLOW QUANDARY.

Patricia L. Samuel, Department of Chemistry, Boston University, 590 Commonwealth Avenue, Boston, MA 02215.

Teaching Fellows and Assistants find themselves in the often uncomfortable position of having many responsibilities but very little power. Their time and attention are divided by duties as both teacher and student. They must work with students of diverse academic and cultural backgrounds and expectations. Those who are from another country bear the additional burden of adjusting to a new environment, including learning current, conversational United States English. In order for Teaching Assistants to be effective teachers, the training they receive must take into account all these factors. Suggestions, drawn from experience with graduate and undergraduate students from many countries, will be offered to help TAs to wear and juggle the hats of teacher, student, and researcher.

TA-10 TEACHING ENHANCEMENT TECHNIQUES FOR THE CHEMISTRY GRADUATE TEACHING ASSISTANT.

Muriel B. Bishop and Carl B. Bishop, Department of Chemistry, Clemson University, Clemson, SC 29634-1905.

Concern over the increasing number of international graduate students teaching in the chemistry laboratory has prompted a more extensive teacher training program for all our teaching assistants.

The materials and techniques used are intended to provide the beginning teacher with a minimum amount of teacher training. The intent of the program is to provide the undergraduate with good teachers and to provide the teacher with polish and confidence. The use of video-taping of the T.A. in the process of giving lab lectures has proven to be an effective tool for letting the T.A. diagnose his/her strong and weak lecture habits.

TA-11 A PRACTICAL TA SCHOOL IN 1.5 DAYS. Stanley Kirschner, Department of Chemistry, Wayne State University, Detroit, Michigan 48202.

Several years ago it became apparent that it is essential that new graduate students in Chemistry, who are to become first-time TA's, require training in techniques for handling quiz and laboratory sections, as well as assistance with many matters related to their instructional duties (e.g., storeroom operation procedures, safety, check-in procedures, etc.). Further, they also require continuing supervision and evaluation by the senior staff to help solve problems that may arise during the course of a semester. Consequently, it was decided to organize a formal "TA School," attendance at which is required of all entering graduate students in Chemistry who have accepted appointments as teaching assistants. A determined effort was made to hold the school over a period of 1.5 days, which required extremely effective use of this limited time period. A typical program of such a "TA School" will be distributed, and a description of the on-going evaluation procedures used in the program will be given. The program has been in operation for several years, has met with considerable success, and has become a permanent part of the Department's requirements of incoming teaching assistants.

TA-12 TRAINING & EVALUATION OF TEACHING ASSISTANTS. R. L. Loeschen, Department of Chemistry, California State University, Long Beach, Long Beach, California 90840

The procedures used for training and supervision of new teaching assistants in general chemistry laboratory and quiz involve presemester orientation, weekly bulletins and midsemester evaluation. In the midsemester evaluation we videotape actual quiz sessions for each teaching assistant and also administer a two page skills rating sheet which the students fill out. After both the teaching assistant and coordinator view the videotape, a private conference is arranged to discuss the results.

Tuesday, July 29, 1986
Computer Hands-on II
276 Strand Union Building

9:00-11:30 AM

CH-09
SOME USEFUL COMPUTER PROGRAMS
Ramette RW

CH-10
TUNING AN NMR SPECTROMETER: A COMPUTER SIMULATION
Lisensky GC

CH-11
COMPUTER USAGE IN THE CLASSROOM
Streator JT

CH-12
REACTIONS IN AQUEOUS SOLUTION - A CAI DEMONSTRATION
Weyh JA, Crook JR

CH-13
USING A SPREADSHEET IN ADVANCED CHEMISTRY COURSES
Wing DA

CH-14
DEMYSTIFYING BRONSTED: A COMPUTER COURSE IN ACID-BASE EQUILIBRIUM
Martin JS

CH-15
CLASSROOM USAGE OF COMPUTER GRAPHING
Rowe FJ

CH-09 SOME USEFUL COMPUTER PROGRAMS

R. W. Ramette, Carleton College, Northfield, MN 55057

The following programs, written by the author, will be discussed: (a) TRIVGAME, an approach to teaching facts, resembling Trivial Pursuit. (b) FABTIC, the Final Acid-Base Titration Curve Program, dealing with any mixture of acids and bases. (c) FLEXFIT, a nonlinear regression program. (d) ALPHA, to plot distribution diagrams for acid-base and metal-ligand systems. (e) NRPLOT, to demonstrate the Newton-Raphson method of finding roots. (f) NAASIM, to simulate the growth and decay of radioactive species in a nuclear reactor. (g) FLEXPLOT, to make plots of data and/or theoretical curves. (h) PHCAL, to calculate the pH of various solutions, including corrections for activity coefficients. (i) QUIZZES, to generate on a time-sharing system a different quiz for each student, including all record-keeping.

CH-10 TUNING AN NMR SPECTROMETER: A COMPUTER SIMULATION

George C. Lisensky, Chemistry Dept, Beloit College, Beloit, WI 53511

The greatest use of instrument time when a student records a continuous wave NMR spectrum is not the scan time, but the time required to tune the instrument. A computer simulation, written for the Apple IIe, provides practice in tuning. This program allows adjustment of amplitude, phase, resolution, scan width, and sweep offset. Depending on the phase and resolution selected, an actual spectrometer scan is BLOADed from disk in 3.5 seconds and then plotted on the screen using the selected scale factors. The advantage of this program is that it gives you untuned spectra.

CH-11

COMPUTER USE IN THE CLASSROOM

James T. Streator, Department of Chemistry, Manchester College, North Manchester, IN 46962

Computers can be used quite effectively to enhance presentations in the classroom. Over the past few years, computers have been used for in-class presentations of material in beginning, analytical and physical chemistry courses. A variety of techniques will be demonstrated or discussed.

CH-12 REACTIONS IN AQUEOUS SOLUTION.

J. A. Weyh, J. R. Crook, Department of Chemistry, Western Washington University, Bellingham, WA 98225 and L. Hauge, Spokane, WA 99223.

This program provides general chemistry students with extensive drill (239 problems) in writing molecular, total ionic, and net ionic equations for reactions in aqueous solution. A student is given the names of a pair of reactants and must type and balance the molecular equation for their reaction on the computer screen. Then the total and finally, the net ionic equation is written. The program has two special features. First, an editor is used which allows the student to type an equation to the screen and later make changes without re-entering the entire response. Second, diagnostic evaluation of student response is provided at each stage in the development of an equation. The incorrect portion of any term (formula or coefficient) is identified and the student asked to correct the error.

General and problem-specific help is available at all times. Extensive practice in writing formulas, learning solubility rules, weak electrolytes, and gases is provided.

CH-13 USING A SPREADSHEET IN ADVANCED CHEMISTRY COURSES

David A. Wing
Department of Natural Sciences and Mathematics, Grand Canyon College
PO Box 11097, Phoenix, Arizona, 85061

Electronic spreadsheet programs pose great potential for allowing rapid calculations and graphic display of numerical relationships. Such a program has been used for the past two years at Grand Canyon to allow students to explore the behavior of fundamental relationships in upper division analytical and biochemistry courses. Worksheets permit students to change values of molecular parameters and observe the resulting effect on observable quantities. Examples include the effect of changing values of acid dissociation constants on titration curves, variation of pH on extent of metal-EDTA complex formation, relationship between Km and Ki values on the velocity of enzyme catalyzed reactions. Software used is Supercalc 3, Educational Version (Sorcium?IUS, Prentice Hall Inc.), run on IBM-PC's with color graphics board. Demonstration of several worksheets and discussion of lessons learned about their effective use will be presented.

CH-14 DEMYSTIFYING BRONSTED: A COMPUTER COURSE IN ACID-BASE EQUILIBRIUM.

John S. Martin, Department of Chemistry, University of Alberta,
Edmonton, Alberta, Canada T6G 2G2.

When the lecturer or textbook says, "in this solution, three moles of sodium hydroxide react with two moles of phosphoric acid to give a K_2 buffer", most students disconnect. They need procedures for analyzing acid-base systems which will give them a good qualitative idea of what is important at equilibrium - that is, what the predominant solutes are.

We have developed logically structured lesson sequences that present acid-base equilbrium in water entirely from the Bronsted point of view (no hydrolysis!), and which take account of the differences between novice and expert approaches to problem solving.

These concepts and procedures are embodied in a set of computer lessons, on the PLATO system, which start from proton transfer and proceed systematically to complex mixtures, pH calculations, design of buffers, and analysis of titration curves.

CH-15 Classroom Usage of Computer Graphing

F. J. Rowe, Northport HS(NY)

Using two Project Seraphim and one commercial software programs, examples of the usage of graphing by the Apple II computer will be demonstrated. Laboratory, half-life and kinetics data will be inputted into the computer and suggestions will be made of how this interactive machine can be used for both practical and theoretical classroom discussions.

Tuesday, July 29, 1986
Demonstrations by Demonstration II
101 Gaines Hall

9:00AM
Introduction
Session Chair, **Sencen J**

9:05
DE-07
TRANSITION METAL CHEMISTRY, A COLORFUL CHALLENGE TO HIGH SCHOOL STUDENTS
Good G

9:30
DE-08
LABORATORY EXPERIMENTS FOR HIGH SCHOOL STUDENTS
Ogata PH

9:55
DE-09
VANADIUM'S VANITY
Rubeck ML, Moser HC

10:20
DE-10
ENRICHMENT OF DESCRIPTIVE CHEMISTRY THROUGH STUDENT PERFORMED DEMONSTRATIONS.
Skelly K, Zoltewicz S

Moved to Dreyfus presents Monday afternoon

10:45
DE-11
TEACHING SUGGESTIONS FOR OXIDATION-REDUCTION
Stevens GH

11:05
DE-12
THREE EASILY PRESENTED DEMONSTRATIONS
Stevens GH

11:25
DE-13
SAY IT AGAIN? DO IT AGAIN?
Viehland CK

11:50
DE-14
ELEMENT OF THE WEEK—A DESCRIPTIVE CHEMISTRY TECHNIQUE
Horsch E, Berger S, Hill A, Holmquist R

DE-07 TRANSITION METAL CHEMISTRY, A COLORFUL CHALLENGE TO HIGH SCHOOL STUDENTS.

Gladys Good, Arlington High School, Indianapolis, IN 46226

Studying transition metals can be most rewarding to the first year chemistry student. Demonstrations involving color changes and complex ions can be exciting. The "one pots" of Dreyfus '84 certainly capture the attention of students. What an introduction they are to the study of the chemistry of transition metals! In this workshop I hope to show how to introduce the study of transition metals using a number of exciting demonstrations. The discussion includes: variable oxidation states, complex ions, how "d" orbital electrons are used in bonding, some theories of bonding, electrochemistry and crystal structures..

DE-08 LABORATORY EXPERIMENTS FOR HIGH SCHOOL STUDENTS,

Philip H. Ogata, Boulder High School, 1604 Arapahoe, Boulder, CO 80302.

The first of three experiments includes the use of micropipets to find the K_{sp} of $CaSO_4$ by ion exchange column and titration. The second lab is an open-ended experiment that hints at a thermochemical end-point. A third is a research project to find a different Belousov-Shabatinsky reaction. Several other demonstrations to start discussions will also be given.

DE-09 VANADIUM'S VANITY,

Mary L. Rubeck, Box 51 BA Rt 1, Towanda, KS 67144 and Herbert C. Moser, Chemistry Department, Kansas State University, Manhattan, KS 66502.

Vanadium salts are relatively inexpensive and their simply prepared solutions exhibit an array of easily distinguished colors. The reduction of yellow V(V) to blue V(IV) to green V(III) to lavender V(II) by common reducing agents makes this an interesting and nearly ideal set of laboratory reactions. The meaning of a reduction potential series and its use in thermodynamic predictability can be discovered by students using the experiment that will be demonstrated. This presentation is based for the most part on a publication of R.A.D. Wentworth (J. Chem. Educ. 62, 440 (1985)). It will demonstrate the chemical isolation of the V(V) to V(IV) reduction potential by the oxidation of V(IV) and the reduction of V(V) using the following couples: SO_4^{2-}/HSO_3^-, NO_3^-/HNO_2, Cl_2/Cl^- and Br_2/Br^-. The chemically estimated potential will be confirmed with a simply constructed, multiple-cell apparatus which is reference electrode based and can be made easily in the school laboratory with the plans provided. Additional uses of this apparatus will be demonstrated.

DE-10 ENRICHMENT OF DESCRIPTIVE CHEMISTRY THROUGH STUDENT PERFORMED DEMONSTRATIONS,

Kathleen Skelly, Dana Hall School, Wellesley, MA 02181, Susan Zoltewicz, Eastside High School, 1201 Southeast 45 Terrace, Gainesville, FL 32601.

A series of safe, simple student activities, along with some novel materials to carry out these activities, are easily and inexpensively assembled. This workshop includes methods of use and suggestions for integrating these materials into a first course in chemistry. Examples follow. Thin stem disposable pipets are used to illustrate calibration, precipitation reactions, LeChatelier's Principle, use of indicators, and titrations (acid/base or redox). Ziplock baggies are used as gas containers to illustrate buoyancy, relative masses of gases, and molecular weight determinations. Disposable syringes are used to illustrate boiling water at room temperature and shifting equilibria involving gases. Balloons, straws, pipecleaners and rubber tubing are used to illustrate principles of atomic structure and bonding. A number of other student reactions are described in booklet, but not presented due to time limitations.

DE-11 Teaching Suggestions for Oxidation-Reduction

A lecture-demonstration sequence to develop the concepts of oxidation-reduction; half cells and half reactions; table of reduction half-reactions and standard electrode potentials for the secondary Chemistry course.

DE-12 Three easily presented demonstrations to help develop:

1. Concept of molar volume of solid compared to gas using dry ice;
2. Interest in and appreciation of Rutherford's scattering experiments using gold foil and gold foil electroscope;
3. Semi-quantitative measurement of ionization constant of ethanoic acid using conductivity apparatus.

DE-13 "SAY IT AGAIN? DO IT AGAIN?", Claudia K. Viehland, 19 Bellerive Acres, St. Louis, MO 63121

A very real problem to the student with acute science anxiety is the new context for many common English vocabulary words, such as "mass" and "volume". Referring to the "volume of the mass" for many students is to say that the music was too loud in church! A lighthearted discussion of some of the vocabulary problems and some ways to treat them should lead to more enlightened students.

Do it again? Or "gotcha" both describe demonstrations for which the results are not immediately obvious to the student. Demonstrations are often remembered better if the results are somewhat startling and unexpected. Such demonstrations have longer retention times in student memory, and can be referred to again and again in different contexts. The emphasis of the presentation will be on memorable but easy-prep demonstrations for busy teachers.

DE-14 ELEMENT OF THE WEEK--A DESCRIPTIVE CHEMISTRY TECHNIQUE. Elizabeth Horsch, Sue Berger, Allen Hill, and Dick Holmquist- 1985 Dreyfus Institute Master Teachers. Sentinel H.S.,Missoula, MT. 59801

> "To be liberally educated is to be knowledgeable, imaginative, articulate, and observant. To become liberally educated one needs something to be knowledgable, imaginative, articulate and observant about!"

Most of us would agree that this is the essence of education. In our science classes, however, we often fail to deal with the implied challenge of the second statement. Ideally science teaching should motivate students to explore, explain,probe and question. Most all students need to be given something to be imaginative and articulate about.

This paper describes a technique to initiate this process. Each week a different element is selected and its properties and reactions are explored. Students begin to develop an observational framework to support chemical theory. For the teacher it is enormously satisfying to be forced to introduce chemical concepts to explain why helium is such a dull element!

Tuesday, July 29, 1986
Quantitative Lecture-Hall Experiments
101 Gaines Hall

1:00PM
Introduction
Session Chair, **Shaw DB**

1:05
DQ-07
USING A SMALL ELECTROPLATING TANK TO ILLUSTRATE FARADAY'S LAW OF ELECTROLYSIS
Sturtevant FF

1:05
DQ-08
DEMONSTRATION OF AN INEXPENSIVE COLORIMETRIC INTERFACE
Hartman K

1:05
DQ-09
A QUANTITATIVE MICROCOMPUTER LECTURE DEMONSTRATION OF AN EQUILIBRIUM REACTION
Gelder JI, Snelling RE

1:05
DQ-10
A QUANTITATIVE LOOK AT THE "OLD NASSAU" CLOCK REACTION
Ealy Jr JW

1:05
DQ-11
THE PHENOMENOLOGICAL GAS LAWS
Bodner GM

DQ-07 USING A SMALL ELECTROPLATING TANK TO ILLUSTRATE FARADAY'S LAW OF ELECTROLYSIS.
F. F. Sturtevant, Ames High School, Ames, Iowa 50010

This demonstration will use small versions of commercial electroplating tanks and bright acid copper and bright nickel plating solutions. Quantitative data will be taken to determine the relationships between the current and quantity of products at the electrodes.

Copper and nickel will be deposited on Ag-coated leaves. The product produced will have a bright metal jewelry-like finish. Technical details for construction of small electroplating tanks for student use will be provided at a workshop.

An extension of this demonstration uses a design where hydrogen gas is collected in a gas collecting tube at one of the electrodes. From data gathered, the number of atoms in a hydrogen molecule can be determined.

DQ-08 DEMONSTRATION OF AN INEXPENSIVE COLORIMETRIC INTERFACE. Ken Hartman, Ames Community Schools, Ames, Iowa 50010.

A fixed wavelength colorimeter, the Blocktronic, has been developed by Project SERAPHIM. The device interfaces with an Apple II series or Commodore 64 microcomputer through the game paddle port. Absorbance data can be collected continuously or at fixed time intervals. The use of the Blocktronic to collect kinetics data will be demonstrated.

DQ-09 A QUANTITATIVE MICROCOMPUTER LECTURE DEMONSTRATION OF AN EQUILIBRIUM REACTION. J. I. Gelder and R. E. Snelling, Department of Chemistry, Oklahoma State University, Stillwater, Oklahoma 74078.

Chemical equilibrium can be a difficult concept to introduce to general chemistry students. In order to expose students to macroscopic examples of chemical equilibrium several common lecture demonstrations can be used;

1. NO_2/N_2O_4
2. $CrO_4^{2-}/H^+/Cr_2O_7^{2-}$
3. $CoCl_2$(alcohol)/$Co(H_2O)_6^{2+}$(alcohol)

At Oklahoma State University we use a computer simulation of an equilibrium reaction, at the microscopic level, to provide students with a model of a dynamic equilibrium. The program follows the general equation;

$$A_2(g) + B_2(g) \leftrightarrow 2AB(g)$$

animating the chemical reaction in real time. The machine language program maintains a count of the amount of each reagent and outputs the numeric information to the screen. Students are able to see collisions between 'reactants' and 'products' while the reaction proceeds towards, and attains, equilibrium.

The program can be used to introduce several quantitative aspects of chemical equilibrium. The discussion reinforces the importance of the stoichiometry of change and establishs the need to have a parameter, which we call the equilibrium constant, as a property of the chemical reaction. The discussion used with the computer simulation is intended to develop the student's confidence of some types of quantitative calculations used in chemical equilibrium.

DQ-10 A QUANTITATIVE LOOK AT THE "OLD NASSAU" CLOCK REACTION. Jim Ealy, The Hill School, Pottstown, PA 19464

Three colorless solutions (sodium hydrogen sulfate, mercury(II) chloride, and potassium iodate) are mixed together and the solution will turn orange and then suddenly blue. By varying the concentrations of the solutions, various reaction times can be obtained and related to the concentration of the mercury II chloride solution.

DQ-11 THE PHENOMENOLOGICAL GAS LAWS. George M. Bodner, Department of Chemistry, Purdue University, West Lafayette, IN 47907.

There are many excuses for doing lecture demonstrations or lecture experiments. They are fun; they grab the students' attention; they can be spectacular; students like them; they provide breaks that help both students and staff recover from the deluge of information in the typical lecture. These are all legitimate reasons for doing demonstrations, but there is another reason as well: they teach chemistry. This paper will look at a series of demonstrations/experiments which can be used as the basis for teaching the phenomenological gas laws: Boyle's Law, Amonton s Law, Charles' Law, Avogadro's Law, Dalton's Law and Graham's Law.

Tuesday, July 29, 1986
General Session
Strand Union Ballroom - D

2:40PM
Introduction
Session Chair, George B

2:45
GN-01
IS SOMETHING MISSING IN CHEMICAL EDUCATION?
George B, Perkins RI

3:05
GN-02
LIBERAL ARTS COLLEGES AND THE FUTURE OF BASIC SCIENCE
Stanitski CL

3:25
GN-03
NUCLEAR CHEMISTRY: INCLUDE IT IN YOUR CURRICULUM
Atwood CH

3:45
GN-04
FRAUD IN GENERAL CHEMISTRY
Hawkes SJ

4:25
GN-06
BIOCHEMISTRY IN THE UNDERGRADUATE CURRICULUM
Outlaw HE

4:45
GN-07
ACADEMIC-INDUSTRIAL INTERFACE AT THE COMMUNITY COLLEGE LEVEL
Sabourin JM

5:05
GN-08
HIGH SCHOOL CHEMISTRY: RECOMMENDATIONS FROM THE OTHER END OF THE PIPELINE
Schucker M

GN-01

IS SOMETHING MISSING IN CHEMICAL EDUCATION?, Babu George, Sacred Heart Univ., Bridgeport, CT, 06606, Ron Perkins, Greenwich High School, Greenwich, CT.

How can we instill professionalism in our students? Both high schools and colleges should address this question. Are we emphasizing values and honor in sciences? What are the responsibilities of science teachers in high schools and colleges? What is the effect of our own behavior on our students? How are we training our students to deal with the negative feelings toward Chemistry in the public eye. What is the responsibility of the scientist towards society? Are we training our students to deal with these issues.

Answers to these questions will be sought along with some possible solutions.

GN-02 LIBERAL ARTS COLLEGES AND THE FUTURE OF BASIC SCIENCE, Conrad Stanitski, Franklin and Marshall College, Lancaster, PA 17604

Selective liberal arts colleges have historically been both significant sites of basic scientific research and prolific sources of future PH.D.s in the basic sciences. Their continuining ability to remain so is jeopardized by existing federal funding levels and allocation practices.

This presentation will describe various trends in undergraduate science education and chemical education related to the sources and supplies of graduate students, the outlook for replenishing the science professoriate, and federal funding and allocation practices.

GN-03 NUCLEAR CHEMISTRY: INCLUDE IT IN YOUR CURRICULUM. Charles H. Atwood, Chemistry Department, Mercer University, 1400 Coleman Avenue, Macon, Georgia 31207

Nuclear chemistry is an important subject and should be included as a part of the freshman general chemistry course. The topics that are covered in nuclear chemistry find relevance in many of today's newspaper stories as well as some of the most recent and exciting scientific discoveries. This talk will discuss reasons for including nuclear chemistry in your curriculum, an estimate of the time required, an outline of a possible course and a discussion of the scientific principles involved in the course. There will also be a brief discussion of some of the newer applications of nuclear processes in medicine.

GN-04 FRAUD IN GENERAL CHEMISTRY, Stephen J. Hawkes, Chemistry Department, Oregon State University, Corvallis, OR 97331.

Dishonesty and incompetence in the teaching of General Chemistry are so pervasive as to constitute a professional disgrace. Six types of fraud will be illustrated and discussed, viz, teaching what isn't so, failure to teach the limitations of principles that are taught, teaching correct but valueless material, failure to teach what students need to know, crowding the curriculum so that average students master very little, and failure to use proved effective methods of increasing learning. These frauds persist for a variety of reasons that interlock and reinforce the status quo. Textbooks must be written to meet the demands of teachers, and teachers will, with few exceptions, stay close to the textbook so each stabilizes the other. National exams must conform to what is generally taught, but in so doing lend authority to the status quo. This pedagogical version of Le Chatelier's Principle frustrates the forces to reform, such as the "Textbook Errors" column in J. Chem. Educ. A solution will be proposed involving simultaneous aggressive action by writers of national exams, by reviewers of textbooks, and by chemical educators, orchestrated by national or international organizations such as ACS.

GN-06 BICHEMISTRY IN THE UNDERGRADUATE CURRICULUM. H. E. Outlaw, Department of Physical Sciences, Delta State Unibersity, Cleveland, Mississippi 38733.

In the past, biochemistry has been treated as a stepchild by chemistry departments and professional chemists. Even now some chemistry departments refer to themselves as "Department of Chemistry and Biochemistry" and worse perhaps is that biochemistry is often taught in Biology Departments by faculty members that have more interest in biology than chemistry. However, the CPT is finally beginning to recognize the importance of biochemistry in the chemistry curriculum and some thought is being given to including biochemistry in the core of courses required for all chemistry majors seeking to be certified by CPT. Accordingly, the role and place of biochemistry in the undergraduate curriculum will be discussed. Also included will be topical outline of the course as well as a list and brief description of lab exercises. Finally, the suggestion will be made that an organic based biochemistry course is appropriate to be included in the core curriculum approved by CPT.

GN-07 ACADEMIC-INDUSTRIAL INTERFACE AT THE COMMUNITY COLLEGE LEVEL. J.M. Sabourin, Department of Chemistry, Delta College, University Center, Michigan 48710.

A small minority of our community college chemistry students will enter academia as a profession while a larger number of students will use their scientific background in business or industry. Presently there is a minimum of and often a lack of exchange between the chemical educator and the industrial chemist. Many questions arise from these two groups regarding the preparations for and expectations of students in industrial careers. Much can be learned by both groups of chemists participating in Visiting Professor programs at area industrial complexes. Such an experience provides first, a wealth of knowledge which the educator can incorporate into teaching and second, furthers academic/industrial interactions via new associations with area professionals. The many facets of such an experience will be discussed as the result of three months spent as a senior research chemist at Dow Corning Corporation at Midland, Michigan.

GN-08 HIGH SCHOOL CHEMISTRY: RECOMMENDATIONS FROM THE OTHER END OF THE PIPELINE. Mel Schucker, Great Valley High School, Route 401 and Phoenixville Pike, Malvern, PA 19355.

If professors teaching the first course in College Chemistry could give their High School counterparts guidance and advice, what would it be? I will present results of discussions with professors from over 125 colleges and universities in 35 states regarding their recommendations for the High School Chemistry course. Opinions and suggestions were tabulated on "the appropriate course content," as well as on problem areas such as: laboratory time, methods, and reports; computer skills and applications; and chemical calculation methods. Data will also be presented relative to S.I. unit compliance, current levels of laboratory instrumentation, and opinions relative to 2nd year and/or Advanced Placement Chemistry courses.

Tuesday, July 29, 1986
Interfacing
275 Strand Union Building

2:40PM
Introduction
Session Chair, **Logan R**

2:45
IF-01
THE BLUE-BOTTLE AND YOUR BASIC pHENOLPHTHALEIN-pHADE
REACTION REVISITED
Brickhouse NW, Davenport DA

3:05
IF-02
CHEMICALLY DRIVEN INTERFACING IN THE ANALYTICAL LABORATORY
Gutzmann BW, **Walters JP**

3:25
IF-03
INTERFACING CHEMISTRY EXPERIMENTS AT A SMALL LIBERAL ARTS COLLEGE
Beatty JW

3:45
IF-04
INTERFACING FOR REAL-TIME DATA ACQUISITION AND ANALYSIS IN AN UNDERGRADUATE POTENTIOMETRIC TITRATION EXPERIMENT
Magnuson DT

4:05
IF-05
THE OPERATION AND MODIFICATION OF THE APPLE PADDLE INPUT
Estell JK

4:25
IF-06
USING RECORD/RECALL: EVENT-DRIVEN AQUISITION WITH ADALAB, FOLLOWED BY PLOTTER OR SCREEN COMPARISON OF STORED SPECTRA
Lisensky GC

4:45
IF-07
HOW CAN ONE SPEND EQUIPMENT DOLLARS EFFECTIVELY TO BRING INTERFACING INTO UNDERGRADUATE LABS?
Amend JR, Howald RA, Hood E

IF-01 THE BLUE-BOTTLE AND YOUR BASIC pHENOLPHTHALEIN-pHADE REACTION REVISITED.

Nancy Whiteside Brickhouse and Derek A. Davenport, Department of Chemistry, Purdue University, West Lafayette, Indiana 47907.

Since the persuasive advocacy of Art Campbell in his *Why Do Chemical Reactions Occur?* the blue-bottle reaction has deservedly become one of the most popular of all lecture demonstrations. And yet there remain many things about it which we do not yet know, let alone understand. The use of an oxygen-sensitive electrode and a simple computer-interfaced colorimeter (the SERAPHIM Blocktronic I) have made possible a more detailed look at the rates of the initial rise to the blue plateau and the ultimate fade to the colorless solution. While not recyclable, the rapid fading of phenolphthalein pink in strongly basic solutions can also serve as a useful lecture-demonstration of elementary chemical kinetics. At 0.25 M NaOH the reaction can (just) be monitored with a Spectromic-20; at 1.00 M NaOH the speed of the computer-interfaced Blocktronic is required. Similar reactions occur with crystal violet, malachite green, and bromophenol blue in strong base.

IF-02 CHEMICALLY DRIVEN INTERFACING IN THE ANALYTICAL LABORATORY.

Bruce W. Gutzmann and John P. Walters, Dept. of Chemistry, St. Olaf College, Northfield, MN 55057

If an electronic interface is implemented for a specific computer before a chemical motive exists, then the educational value of the result may be obscured by today's rapid hardware evolution. But, if the requirements for the analytical instrumentation, the interface, and the computer are *driven* by a chemical objective, then the educational objectives of learning how to solve chemical problems *and* of learning how to use interfaced computers as problem-solving tools can *both* be emphasized as interdependent parts of a single experiment. This target will be illustrated for junior ("Quantitative Analysis") and senior ("Instrumental Analysis") courses in analytical chemistry using serial and parallel interfaces to pH meters, electronic balances, and two-electrode polarographs. The chemical motives of determining the consequentiality of ionic strength in a polybasic weak acid titration via reversed variable plotting and of determining the influence of solution resistance on a diffusion-limited polarographic waveform via polynomial curve fitting will be presented as *drivers* on the kind of computers and interfacing used.

IF-03 INTERFACTING OF CHEMISTRY EXPERIMENTS AT A SMALL LIBERAL ARTS COLLEGE.

J. W. Beatty, Department of Chemistry, Ripon College, Ripon, WI 54971.

Criteria for the selection of appropriate interfacing experiments will be discussed. Interfacing experiments using Commodore and Apple computers will be presented. These experiments include the use of a computer interfaced thermistor bridge thermometer for lecture demonstrations, calorimetry measurements, and freezing point depression measurements. A kinetics experiment using an interfaced conductance meter will also be presented.

Interfacing problems and their resolutions will be considered along with the direction our interfacing experiments will take in the future.

IF-04 INTERFACING FOR REAL-TIME DATA ACQUISITION AND ANALYSIS IN AN UNDERGRADUATE POTENTIOMETRIC TITRATION EXPERIMENT.

D.T. Magnuson, Department of Chemistry, Texas A&M University,
College Station, Texas 77843

An undergraduate redox potentiometric titration experiment has been interfaced to an HP-85 portable computer for real-time data acquisition and analysis. This experiment is used to introduce our undergraduate students to the principles of computer interfacing in the laboratory. This paper will discuss the method used to interface via the IEEE-488 interface, the analysis program used, and the student's response to the experiment.

IF-05 THE OPERATION AND MODIFICATION OF THE APPLE PADDLE INPUT. John K. Estell, Department of Computer Science, University of Illinois, 1304 West Springfield Avenue, Urbana, Illinois 61801.

Over the past few years there has been an increasing interest in the use of the Apple microcomputer's game port for inexpensive interfacing experiments. The majority of these experiments involve the use of the paddle input. However, in doing so they are constrained by both the hardware and software characteristics of the original design. By investigating the operation of the paddle input with respect to the hardware and software involved, the design characteristics can be acquired and understood. Furthermore, insight can be obtained as to how these characteristics may be adjusted for various purposes through hardware and software modifications, thereby freeing the experimenter from some of the original constraints. This presentation will explore the operation of the paddle input, examine its characteristics and constraints, and provide both hardware and software methods for modifying its performance.

IF-06 USING RECORD/RECALL: EVENT-DRIVEN DATA AQUISITION WITH ADALAB, FOLLOWED BY PLOTTER OR SCREEN COMPARISON OF STORED SPECTRA
George C. Lisensky, Chemistry Dept, Beloit College, Beloit, WI 53511

The goal of computer interfacing should be to make things easier. We have found that interfacing an Apple computer to an Acculab Infrared Spectrometer provides a convenient way of storing spectra. Recall of pairs of spectra to the screen for comparison (with scale expansions or offset), and plotter overlays of spectra in different colors (with scale expansions), have made student interpretation of data easier even at the introductory level. The presentation will include discussion of experiments which are improved by such manipulations. Some examples include hydrogen-bonding as a function of dilution, kinetic studies, comparison of isomers, and creating a spectral library of polymers for student identification of unknowns. The RECORD/RECALL programs are available from Project SERAPHIM.

IF-07 HOW CAN ONE SPEND EQUIPMENT DOLLARS EFFECTIVELY TO BRING INTERFACING INTO UNDERGRADUATE LABS?, J.R. Amend, R.A. Howald, E.S. Hood, Montana State University, Chemistry Department, Bozeman, MT 59717.

Much of the cost of discrete laboratory instrumentation may be saved by using a common data processor and experiment-specific detectors. Montana State University is revising their freshman chemistry laboratory program, providing a personal-computer based work stations for each laboratory group. These computers serve the following functions: (1) tutorial exercises; (2) data acquisition; (3) data analysis; and (4) grading and record keeping. The program is based on an easily-constructed, low-cost interface card which provides data acquisition for experiments ranging from temperature measurements and pH curves to nuclear counting and spectral analysis. This card is the only major component of the system not commercially available at reasonable price and accuracy.

Tuesday, July 29, 1986
POSTERS II
276 Strand Union Building

2:30-5:00PM

PO-15
MAKING COMPUTER SLIDE SHOWS
Roe Jr R, Schulz WW

PO-16
ENVIRONMENTAL AND TOXICOLOGICAL CHEMISTRY IN COLLEGE AND HIGH SCHOOL CHEMISTRY CURRICULA
Manahan SE

PO-17
MICROCOMPUTER GRAPHICS AND QUANTUM MECHANICS
Rioux F

PO-18
ELECTRONIC SPREADSHEETS--NEW TOOLS FOR SCIENTIFIC PROBLEM SOLVING
Joshi BD

PO-19
DID E=mc2 INVALIDATE THE LAW OF CONSERVATION OF MASS?
Treptow RS

PO-20
MEASUREMENTS ON U.S. ONE-CENT PIECES
Freeman WA

PO-21
A GC/MS WORKSHOP AND LABORATORY ASSIGNMENT FOR UPPER LEVEL CHEMISTRY MAJORS
Vestling MM

PO-22
A MODEL OF THE ELECTRONIC STRUCTURE OF THE ATOM
Bricker CE

PO-23
NUMERICAL METHODS, STATISTICAL METHODS AND PLOTTING USING COMPUTERS
Rosenthal D

PO-24
AN INEXPENSIVE A/D INTERFACE FOR COMMODORE C-64 COMPUTER: AUTOMATED TITRATION EXPERIMENT
Whitla WA

PO-25
FAR-FROM-EQUILIBRIUM MODEL SYSTEMS
Soltzberg LJ

PO-26
STRIPPING SODIUM
Schrader C

PO-27
RELATIVE LIFTING POWER OF HYDROGEN AND HELIUM: A GAS BUOYANCE DEMONSTRATION EXPERIMENT
Burgstahler AW, Wandless T, Bricker CE

PO-15 MAKING COMPUTER SLIDE SHOWS. R. Roe, Jr., W. W. Schulz, Highland Park High School, Dallas, Texas 75205.

Techniques for generating slide presentations of graphics and text materials using a light pen, graphics tablet, and commercial computer software will be demonstrated.

PO-16 ENVIRONMENTAL AND TOXICOLOGICAL CHEMISTRY IN COLLEGE AND HIGH SCHOOL CHEMISTRY CURRICULA. Stanley E. Manahan, Department of Chemistry, 123 Chemistry Building, University of Missouri, Columbia, MO 65211.

Environmental chemistry is now well established as a part of many college curricula. This subdiscipline may be defined as "the study of the sources, reactions, transport, effects, and fates of chemical species in the water, soil, and air environments".[1] Toxicological chemistry deals with the chemical nature and chemical and biochemical reactions of toxic substances. Both of these areas are of obvious importance and interest to chemists and chemistry students. Furthermore, both environmental and toxicological chemistry provide abundant examples for the illustration of descriptive chemistry and principles. Means of teaching subject matter from environmental and toxicological chemistry are discussed in this paper.

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[1] *Environmental Chemistry*, 4th ed., Stanley E. Manahan, Brooks/Cole Publishing Co., Monterey, CA, 1984, p. 3.

PO-17 MICROCOMPUTER GRAPHICS AND QUANTUM MECHANICS. Frank Rioux, Department of Chemistry Saint John's University, Collegeville, MN, 56321.

Numerical solutions to Schroedinger's equation for one-dimensional cases are well-known and easy to program. This coupled with the graphics capability of the microcomputer provide the teacher with a powerful method for teaching quantum mechanics to undergraduates.

In this paper a finite difference algorithm is employed to obtain numerical solutions to the following quantum mechanical problems: the particle in the infinite potential well, the perturbed particle in the infinite potential well, the one-dimensional H atom, quantum tunnelling, and the van der Waals interaction. The solutions are displayed using an Apple II microcomputer.

PO-18

ELECTRONIC SPREADSHEETS — New Tools for Scientific Problem Solving.

Bhairav D. Joshi, Department of Chemistry, State University College, Geneseo, NY 14454

Electronic spreadsheets have been generally thought of as programs useful for bookkeeping and business oriented applications. However, a closer look at the facilities provided by some of these programs reveals that they are also well suited for use as scientific problem solving and data analysis tools. This paper focuses on the ways we have been using Lotus 1-2-3 for solving physical chemistry problems on an IBM PC. The power of this program for scientific applications primarily comes from the following features it provides: large spreadsheet size, relative and absolute addressing of cells, recursive and iterative computation of functions, selection and sorting of tabulated results, graphical representation of tabulated data, and creating programs — called macros, using Lotus 1-2-3 commands to do special tasks. Three types of problems will be used as illustrations: **1)** iterative problems, i.e., the Newton's method for finding roots of equations, **2)** recursive computation and high resolution graphics display of non-trivial functions, i.e., Hermite polynomials and harmonic oscillator wave functions, and **3)** curve fitting, and assessing the degree of the fit, i.e., expanding a given function in terms of a complete orthonormal set of functions. Lotus 1-2-3 templates that solve these problems will be presented and discussed.

PO-19

DID $E=mc^2$ INVALIDATE THE LAW OF CONSERVATION OF MASS?

R. S. Treptow, Department of Physical Sciences, Chicago State University, Chicago, Illinois 60628.

Since the days of Lavoisier, we chemists have believed in the indestructibility of mass. Early in this century our confidence was shaken by the special theory of relativity. The theory asserts that mass and energy are equivalent. A body's mass is a measure of its energy, and vice versa. If a system emits energy it must lose mass. Conservation of mass is invalid for any system which exchanges energy with its surroundings. But, the law of conservation of energy assures us that any energy emitted by a system is gained by its surroundings. The surroundings therefore gain mass in an amount equal to that lost by the system. Conservation of mass is perfectly valid if we include both the system and its surroundings. The total mass of the universe is constant. This paper will attempt to dispel the myth that mass can be converted into energy.

PO-20

MEASUREMENTS ON U.S. ONE-CENT PIECES.

Wade A. Freeman, Department of Chemistry, University of Illinois at Chicago, Chicago, Illinois 60680

Common-date U.S. one-cent coins (pennies) fall into two categories of mass. Those minted after 1982 are lighter than those minted before. A quantitative demonstration in which students help to gather data on the masses of 15-25 pennies, reporting the results in writing, can effectively introduce discussion of uncertainty in measurements, the use of significant digits, accuracy, precision, frequency distributions and the standard deviation. A lengthier list of penny masses clearly shows the existence of "penny isotopes" and is useful in teaching about elemental isotopes and the atomic weight of an element as the abundance-weighted mean of the atomic weights of its isotopes. Although penny isotopes are financially identical, they do differ chemically (one mainly copper, the other mainly zinc). Comparative reactions with nitric acid demonstrate this point.

PO-21 A GC/MS WORKSHOP AND LABORATORY ASSIGNMENT FOR UPPER LEVEL CHEMISTRY MAJORS. Martha M. Vestling, Chemistry Department, SUNY College at Brockport, Brockport, NY 14420.

Since one improper use can take a mass spectrometer out of service, there is a great and reasonable reluctance to let a whole class of undergraduates operate such an instrument. It is, however, highly desirable for undergraduates to become familiar with mass spectrometry. We use a mass spectrometer which is coupled to a capillary gas chromatograph and a Winchester disk drive. In one laboratory period, we can run twelve different mixtures and demonstrate many of the options available to the operator. It is one thing to read about gc/ms in an instrumental analysis textbook, and it is quite another thing to be stuck with several spectra to analyze. Students are generally totally unaware of the vast library of mass spectra already available, the sample sizes involved, and the parts of a good vacuum system. This paper will describe our students' assignment in detail.

PO-22 A MODEL OF THE ELECTRONIC STRUCTURE OF THE ATOM. Clark E. Bricker, Department of Chemistry, University of Kansas, Lawrence, KS 66045

A graphic demonstration depicting the arrangement of the first ten electrons in an atom will be shown. When ten small pencil magnets, that are attached individually and in the same direction to corks, are dropped into a pan of water that has a D.C. induced magnetic field around it, the corks, representing electrons, arrange themselves so that two are in the center and eight surround these two in a larger circle - just like the first ten electrons in an atom.

If the polarity of the D.C. is now reversed, all the corks will migrate to the periphery of the pan of water. When the polarity of the D.C. is again reversed, the corks return to their 2 and 8 configuration but the actual corks that are in the center are seldom the same corks that were there the first time. This phenomenon illustrates that all electrons are the same, that they are completely random and that the same electrons are not always at the same place in the atom.

PO-23 NUMERICAL METHODS, STATISTICAL METHODS AND PLOTTING USING COMPUTERS. Donald Rosenthal, Department of Chemistry, Clarkson University, Potsdam, NY 13676.

The availability of computers makes it possible for undergraduates to perform numerical and statistical calculations and plotting which would otherwise be very time consuming. While students are not required to understand how these calculations are performed, it is important that they understand the principles of these techniques and be able to interpret the results obtained. The software should be easy to use.

The way in which these techniques are introduced and used in freshman level and more advanced courses at Clarkson will be discussed.

PO-24 AN INEXPENSIVE A/D INTERFACE FOR THE COMMODORE C-64 COMPUTER: AN AUTOMATED TITRATION EXPERIMENT. W. A. Whitla Department of Chemistry, Mount Allison University, Sackville, New Brunswick, EOA 3CO, Canada.

This paper will describe a controlled accuracy (8 to 12 bit) anologue to digital interface using a Commodore C-64 computer. At the maximum accuracy, digitization is approximately 15 data points per second with greater than 12 bit accuracy for a 1 V signal. Lower accuracy takes proportionally less time per data point. (e. g. 8 bit accuracy, 2.6 ms/data point).

The interface will accept any signal from 0-1.00v and has a very high imput impedance (>200M).

An automated titration using a constant delivery burette (J. Chem. Educ. 49, 535, (1972)) will be used to illustrate the applications of the interface in the undergraduate laboratory. Software for plotting, interpreting and printing the titration curve will be demonstrated. Application for kinetics experiments may also be shown.

PO-25 FAR-FROM-EQUILIBRIUM MODEL SYSTEMS. Leonard J. Soltzberg, Department of Chemistry, Simmons College, 300 The Fenway, Boston, MA 02115.

The importance of far-from-equilibrium processes is reflected in the steady increase in work being done in this area in laboratories around the world. As with wave mechanics in an earlier era, this new world-view will gradually find its way into the teaching of chemistry at the undergraduate and secondary levels.

The concepts associated with far-from-equilibrium dynamics are unfamiliar to many chemists. This presentation will summarize key ideas and will describe model systems which facilitate visualization of far-from-equilibrium phenomena. The "gas pendulum", "gas buzzer", and "continuous-flow bottle" are easily-constructed systems which show a broad variety of far-from-equilibrium behavior. Simple computer models will also be described.

PO-26

Stripping Sodium

For almost two decades I have been using the reaction of sodium with water as a culminating activity in chemistry. This reaction illustrates the following principles: Characteristic properties, elements, compounds, mixtures, chemical reactions, the mole, stoichiometry, rates of reaction, equilibrium, the gas laws, modeling, indicators, acid-base reactions, transfer of electrons, oxidation-reduction, pollution, poisons and environmental issues.

The reaction of lithium, sodium, and potassium can be safely demonstrated with phenolphthalein and a petri dish on an overhead projector by reacting very small amounts of the metals. My students always ask, "What if you use large amounts?" I reply the potential for an explosion is excellent and recount some of the demonstrations I have seen or done (West Virginia 1985, Chem Ed 1985) which got out of control.

Because of the potential hazard of sodium reacting with water, it is packed in sealed containers or stored under kerosene. I show the students a 500 gram (20 moles) stick of sodium and showslides of the reaction of a similar stick of sodium with the water in a strip mine pit. On the last day of school, we react a large piece (20-50 moles) of sodium with the water in a strip mine owned by a former student. The reaction is spectacular but safe. A video tape will be shown of the reaction and any teacher who would like a copy of the video tape may obtain one from me.

PO-27 THE RELATIVE LIFTING POWER OF HYDROGEN AND HELIUM: A GAS BUOYANCY DEMONSTRATION EXPERIMENT. Albert W. Burgstahler, Tom Wandless, and Clark E. Bricker, Department of Chemistry, The University of Kansas, Lawrence, Kansas 66045.

Since helium is twice as heavy as hydrogen, many students--unless they think carefully about it--will incorrectly predict that helium has only half the lifting power of hydrogen. From Avogadro's law and Archimedes's principle, the lifting power of helium in air is readily calculated to be 92.6% that of hydrogen. It is also instructive, as well as interesting, to demonstrate this fact experimentally.

A Mylar balloon (ca. 10-12-liter capacity), together with a piece of string, is weighed and filled with dry helium to a reproducible volume at a fixed low pressure of ca. 15 cm of water. The balloon is then attached to a preweighed object and the decrease in weight is recorded. Afterward, the balloon is completely emptied, and the procedure is repeated with hydrogen. In a typical experiment, an average lifting power of 13.09 g was found for helium and 14.20 g for hydrogen, thereby indicating, in good agreement with theory, that helium has 13.09/14.20 = 0.922 or 92.2% the lifting power of hydrogen.

Tuesday, July 29, 1986
Microscale Organic Laboratory II
Strand Union Ballroom - D

8:00PM
Introduction
Session Chair, **Pike RM**

8:05
MC-08
TEN THOUSAND MILES THROUGH THE ORGANIC LAB: THE ANTHROPOLOGY OF ORGANIC CHEMISTRY
Pickering M

8:30
MC-09
IMPLEMENTATION OF THE MICROSCALE ORG. CHEM. LAB. IN A STATE UNIV. SYS.
Sundin CE

8:50
MC-10
AN EVALUATION OF THE CONVERSION TO A MICROSCALE ORGANIC LABORATORY AND ITS FIRST YEAR OF OPERATION
Tweedie V

9:10
MC-11
MICROSCALE ORGANIC LABORATORY IN A FIVE MILLILITER CONICAL FLASK
Goodwin TE

9:30
MC-12
MICROSCALE ORGANIC LABORATORY...DOING IT INEXPENSIVELY.... NOT CHEAP!!!
Daly JM

9:50
MC-13
SMALLER AND SMALLER AND SMALLER: MAKING THE TRANSITION TO THE MICROSCALE LEVEL
Weill III DR

MC-08 TEN THOUSAND MILES THROUGH ORGANIC LAB: THE ANTHROPOLOGY OF ORGANIC CHEMISTRY.

Miles Pickering, Department of Chemistry Princeton University, Princeton, NJ 08544

It is clear that most labs in organic chemistry really do not illustrate the method or thinking of present day organic chemists. This paper considers how such thinking might be illustrated, how freshman chemistry might better prepare students for organic, and how microscale work can be used to meet educational objectives, not just solve cost and safety problems.

MC-09 IMPLEMENTATION OF THE MICROSCALE ORGANIC CHEMISTRY LABORATORY IN A STATE UNIVERSITY SYSTEM, I,

Charles E. Sundin, Department of Chemistry, The University of Wisconsin-Platteville, Platteville, WI 53818.

The claims by Mayo, et. al., that the Microscale Organic Chemistry Laboratory is safer, more economical, and pedagogically better than the traditional undergraduate organic chemistry laboratory prompted us to accept the self-imposed challenge of bringing the microscale organic laboratory to the University of Wisconsin System. With the realization that the implementation of any new program in academia faces the hurdles of faculty skepticism, fiscal restraints, and bureaucratic inertia, we developed a seemingly straightforward solution involving six components: 1) testing this microscale approach by one instructor; 2) testing this microscale approach by one laboratory section; 3) mini hands-on workshop for remaining faculty at initial campus; 4) teaching this microscale approach by the newly trained faculty; 5) hands-on workshop for faculty from other campuses; and 6) teaching this microscale approach at other campuses. This preliminary report will elaborate on our experiences with the first three components and our plans for the last three.

MC-10 AN EVALUATION OF THE CONVERSION TO A MICROSCALE ORGANIC LABORATORY AND ITS FIRST YEAR OF OPERATION.

Virgil Tweedie, Department of Chemistry, Baylor University, Waco, Texas 76798

Although semimicro and micro procedures have been well-established for analytical purposes, only recently have microscale procedures been developed for the undergraduate organic laboratory. [Mayo, D.W., Pike, R.M., and Butcher, S.M., "Microscale Organic Laboratory," John Wiley and Sons, New York, 1986] Beginning with the 1985-86 academic year, all sections of our sophomore organic laboratory were converted to microscale operation. The results have been highly satisfactory and rewarding. This talk will discuss, among other topics, factors influencing the decision for a microscale laboratory, costs related to the conversion, breakage and operational costs, environmental and safety considerations, waste disposal, quality of instruction, and student response, performance, and evaluation.

MC-11 MICROSCALE ORGANIC LABORATORY IN A FIVE MILLILITER CONICAL FLASK.

Thomas E. Goodwin, Department of Chemistry, Hendrix College, Conway, AR 72032

About one year ago, having found ourselves attracted to the many inherent and obvious benefits of the Microscale Organic Laboratory (MOL) of Messrs. Mayo, Pike and Butcher, we began experimenting with the incorporation of various aspects of their program. We wished to test the microscale concept with a minimal expenditure of funds, using as much of our available equipment as possible, as a prelude to complete conversion eventually. We have been able to carry out many of the MOL experiments successfully using a five milliliter conical flask (19/22 joint) as a reaction vessel and quite often as a separatory funnel. We will describe our implementation of this "modified" microscale program and will suggest it as a viable mode of conversion from a traditional macroscale laboratory at a minimal start-up cost. In addition, several new experiments for the microscale laboratory will be discussed.

MC-12 MICROSCALE ORGANIC LABORATORY...DOING IT INEXPENSIVELY....NOT CHEAP!!!

John M. Daly, Department of Chemistry, Bellarmine College, Louisville, KY 40205.

The chemistry department at the college has developed a microscale organic laboratory course over the past several years. To retrofit an organic chemistry laboratory for microscale manipulations is not an inexpensive venture. As an alternative to this we have developed an approach which utilizes vortex stirrers, centrifuge tubes, Pasteur pipets and a heavy reliance on instrumentation for product identification. A reasonable amount of equipment has been fabricated on site. While this lacks the polish of commercial products it does get the job done. The paper will outline the successes..... and some of the failures of our program. The author will have available copies of some experiments that might be of interest to those who wish to experiment in this exciting field. Our whole approach is geared to doing micro laboratory inexpensively and in a fashion that does not cheapen the pedagogical approach to the subject matter.

MC-13 SMALLER and SMALLER and SMALLER: MAKING THE TRANSITION TO THE MICROSCALE LEVEL, David R. Weill III, Department of Science, Shady Side Academy, 423 Fox Chapel Road, Pittsburgh, PA 15238, U.S.A.

The handling of minute quantities of reagents and solvents in small apparatus and performing microscale manipulations can be a challenging task. Microscale laboratory work demands scruplous attention to details in order to achieve high performance objectives.

This paper will describe an experiment that can enable students to make an easier transition from the macro to the microworld. The experiment presents the student with a series of increasinly more challenging crystallizations and separations of an organic diacid from a highly colored organic dye. The experiment is approached from an historical as well as technical perspective. The adoption of increasingly narrow performance specifications demonstrates to the student accuracy as well as precision objectives. The experiment uses simple apparatus and progressively smaller and smaller quantities of chemicals.

Adoption of this experiment has improved the laboratory performance of our students at the microscale level. It has made the transition easierand has increased the pleasure of their laboratory experience.

Tuesday, July 29, 1986
Symposium
Computer Applications
276 Strand Union Building

8:00PM
Introduction
Session Chair, **James ML**

8:00PM
CS-01
SYMPOSIUM: IMPLEMENTING THE COMPUTER AS AN INTEGRAL AID TO THE CHEMISTRY TEACHER
James ML

8:20
CS-02
COMPUTER INTERFACING DEVICES AS USEFUL TOOLS IN THE SCIENCE CLASSROOM
Berman-Robinson S, Marek L

8:40
CS-03
MAKING COMPUTERS AND RELATED TECHNOLOGY AN INTEGRAL PART OF YOUR CLASSROOM
Roe Jr R

9:00
CS-04
THE FIRST DECADE OF PC USAGE IN A LIBERAL ARTS COLLEGE CHEMISTRY DEPARTMENT
Beatty JW, Oyster TJ

9:20
CS-05
CHEMICAL EDUCATION AND THE COMPUTER: MARRIAGE, LIVE-IN COMPANION, OR PEACEFUL COEXISTENCE
Hartman KA

9:40
CS-06
IMPROVING STUDENT ATTENTIVENESS WITH A CLASSROOM COMPUTER
Soltzberg LJ

CS-01 SYMPOSIUM ON "IMPLEMENTING THE COMPUTER AS AN INTEGRAL AID TO THE CHEMISTRY TEACHER". M. Lynn James, Department of Chemistry, University of Northern Colorado, Greeley, Colorado, 80639.

At this point in time, we have made a great deal of progress toward the acquisition of computer hardware in most schools. In addition, there is a great variety of good and not so good software available for use in the chemistry classroom and laboratory. In the vast majority of schools, however, little practical use is made of the computer as an aid to the chemistry teacher. This symposium will present five model approaches to such uses on both the high school and college level. The individual presentations will be followed by a question/answer panel discussion by the speakers.

CS-02 COMPUTER INTERFACING DEVICES AS USEFUL TOOLS IN THE SCIENCE CLASSROOM. Sherry Berman-Robinson and Lee Marek. Carl Sandburg High School, Orland Park, IL 60462 and Naperville North High School, Naperville, IL 60540.

Many people have heard the words "computer interfacing" or "game port interfacing", but are somewhat puzzled or frightened by these words. This presentation will show participants how simple inexpensive interfacing devices (which can be built through SERAPHIM) can be used to enhance classroom learning as well as to excite and to challange students. Sample classroom interfacing experiments will be demonstrated.

CS-03 MAKING COMPUTERS AND RELATED TECHNOLOGY AN INTEGRAL PART OF YOUR CLASSROOM. R. Roe, Jr., Highland Park High School, Dallas, Texas 75205.

Computers and computer based technology are integral aids in teaching science and are transforming our classrooms into the classrooms of the future.

The preparation of teaching materials using a computer and a video cassette recorder, the use of a large screen projection monitor to display computer and video camera displays, the integration of computer interfacing experiments into the curriculum, and the use of interactive video using a laser disk-computer system will be discussed.

CS-04 THE FIRST DECADE OF PC USAGE IN A LIBERAL ARTS COLLEGE CHEMISTRY DEPARTMENT. James W. Beatty and Thomas J. Oyster, Chemistry Department, Ripon College, Ripon, WI 54971

Our efforts over the past ten years to take advantage of modest computer facilities and funds will be described. Expectations and the final realizations of specific usage attempts will be given along with directions we plan to take in the future. The reasons we shifted from our campus wide computer system to almost exclusive personal computer (PC) usage will be presented.

The PC has helped faculty improve the quality of instruction and departmental, classroom, and professional administration with more ease for about the same effort. A similar improvement in the quality and ease of the preparation of reports by students using PC word processing has been noted. Efforts at computer usage in the areas of computer assisted instruction (CAI), chemical computation, computer assisted preparation of instruction and examination materials, and computer interfacing will be given. We believe that differences in the small college and university environments force different outcomes for computer usage by students and faculty.

CS-05 CHEMICAL EDUCATION AND THE COMPUTER: MARRIAGE, LIVE-IN COMPANION, OR PEACEFUL COEXISTENCE. K. A. Hartman. Ames Senior High School, 20th and Ridgewood, Ames, Iowa 50010.

The relationship of computing technology to chemical education can develop in one of three ways: (1) Little or no relationship other than coexistence in the curriculum; (2) Using the computer to augment a portion of the chemistry course as a means of promoting computer literacy in a science and technology curriculum area; and (3) Using the computing technology to enhance and improve the quality of the science (chemistry) education program. This paper proposes to "marry" computers and chemical education to make the teaching process more exciting as well as produce a better prepared citizen for the information age.

CS-06 IMPROVING STUDENT ATTENTIVENESS WITH A CLASSROOM COMPUTER.

Leonard J. Soltzberg, Department of Chemistry, Simmons College, 300 The Fenway, Boston, MA 02115

Much educational computer software is designed for use by individual students. Another role for the computer is in the classroom itself, where appropriate scftware can be used during lectures to improve students' attention span and to encourage student participation in the development of the topic at hand. Imaginatively used, this approach allows the students to take a more active role during the presentation of new material. By creating an atmosphere of questioning and discovery, the chemistry teacher can not only invest the presentation with a new excitement but can also provide a classroom experience which parallels the hypothesis/experiment process for gaining new understanding of a system.

The implementation of lecture-oriented computer aids is simplified by the fact that only one computer is required for a presentation. An economical solution for classes of about twenty-five or fewer students is the "Apple Cart", an audio-visual cart with an Apple II computer and a large television monitor which can be circulated by a school's AV center.

Tuesday, July 29, 1986
Innovative Programs II
Strand Union Ballroom - B

8:00PM
Introduction
Session Chair, **Cooper T**

8:05
IP-10
"RIVERS & PONDS": AN INTEGRATED SCIENCE AND MATHEMATICS FIELD-STUDY FOR TEACHERS AND STUDENTS
Pulliam EJ, Greenbowe TJ

8:20
IP-11
A DEMONSTRATION EXCHANGE FOR HIGH SCHOOL AND MIDDLE SCHOOL INSTRUCTORS
Barkan DN

8:50
IP-12
RAISING THE UNDERSTANDING AND APPRECIATION OF SCIENCE AND SCIENCE TEACHING
Hill BJ, **Dill D**

9:05
IP-13
CONTENT ENHANCEMENT IN SCIENCE AND MATHEMATICS FOR ELEMENTARY AND SECONDARY SCHOOL TEACHERS
Bouk CC, Borchert DM

9:20
IP-14
THE FUTURE OF STUDENT OPPORTUNITIES IN THE SPACE PROGRAM
Scaife CWJ

9:35
IP-15
ONE HIGH SCHOOL STUDENT'S EXPERIENCE IN THE STUDENT SHUTTLE INVOLVEMENT PROJECT
Scaife CWJ, Cavoli SR

9:50
IP-16
STRUCTURED CHEMICAL PROBLEM SOLVING AND BASIC
Williams HP, Howell JE, Russell JL

10:05
Discussion

IP-10 "RIVERS AND PONDS": AN INTEGRATED SCIENCE AND MATHEMATICS FIELD STUDY FOR TEACHERS AND STUDENTS. E. J. Pulliam and T. J. Greenbowe, Chemistry Department, Southeastern Massachusetts University, North Dartmouth, MA 02747.

"Rivers and Ponds" is a project designed for high school science and mathematics teachers and for gifted and talented students (grades 9 - 12). Regional School Superintendents and teachers wanted to implement a program which would challenge gifted and talented students and offer an integrated approach to the learning experience. Working collaboratively, a committee of high school teachers and university faculty designed and developed the curriculum with the assistance of the Lloyd Center for Environmental Studies. The project focussed on acquainting students with scientific and mathematical techniques for assessing how environmental changes impact regional flora and fauna. Topics addressed during the study included physical, chemical, biological and statistical parameters. We will focus this talk on how the chemistry involved was presented and on how we got started, the problems and successes we encountered, and where we think this project could fit into the high school curriculum.

IP-11 A DEMONSTRATION EXCHANGE FOR HIGH SCHOOL AND MIDDLE SCHOOL INSTRUCTORS. David N. Barkan, Department of Chemistry, Northwest Community College, Powell, WY 82435.

Effective demonstrations can be both fun and educational. They can generate a feeling of excitement that is not possible with a lecture or discussion. Besides generating excitement for the students, demonstrations allow a chance for the chemistry instructor to get involved in actually doing some chemistry, and this seems to vitalize the classroom environment. In coordination, the Chemistry and Physics instructors at Northwest Community College (NWCC) have been sponsoring a demonstration exchange for high school and middle school science instructors. The role of the college in, sources of outside funding for, and overall effectiveness of the exchange will be discussed.

IP-12 RAISING THE UNDERSTANDING AND APPRECIATION OF SCIENCE AND SCIENCE TEACHING, B. J. Hill, Dan Dill, Southwestern Oklahoma State University, Weatherford, OK 73096.

A cooperative effort between Southwestern Oklahoma State University and eight area public school systems, Southwestern Intensive Science Help project (SWISH), will be described and assessed. Project objectives were: (1) to increase awareness of the physical sciences and their importance in society, (2) to raise the confidence and competence of science teachers, (3) to raise the image of science teaching, (4) to establish synergism between the schools and university, and (5) to develop a model which can be employed to improve science education. Activities included: public "Faraday" lectures on a broad range of topics in science and technology; workshops on science and science education; field trips; and social events. Three physicists, three chemists, 1 geologist, 1 meteorologist, and two science educators from the university conducted presentations. Superintendents, principals, and junior high and senior high science teachers participated, in addition to those attending the public lectures.

IP-13 CONTENT ENHANCEMENT IN SCIENCE AND MATHEMATICS FOR ELEMENTARY AND SECONDARY SCHOOL TEACHERS. Clifford C. Houk, Department of Chemistry and Donald M. Borchert, Associate Dean, College of Arts and Sciences, Ohio University, Athens, Ohio 45701-2979.

For three summers Ohio University's College of Arts and Sciences faculty in collaboration with Southeastern Ohio elementary and secondary school teachers and administrators have offered content enhancement courses in science, mathematics, computer science and humanities. The courses were developed and presented as a result of the perceived needs of classroom teachers who felt a need to update their knowledge and skills. They were uncertain, lacked the confidence that they could teach the increased level of science and mathematics suggested by recent national studies and required by increasing numbers of state and local school systems. A summary of courses, results and future plans will be presented. Particular emphasis will be placed upon a course, States of Matter, designed for K-6 teachers taught July 1986.

IP-14 THE FUTURE OF STUDENT OPPORTUNITIES IN THE SPACE PROGRAM, Charles W. J. Scaife, Department of Chemistry, Union College, Schenectady, NY 12308

Prior to the tragic explosion of the Challenger, the National Aeronautics and Space Administration sponsored a variety of programs that provided research opportunities for both high school and college students. These opportunities ranged from the formal Shuttle Student Involvement Project for high school students to the informal internships and get-away-specials for both high school and college students. It may be a considerable time before future shuttle flights. Will military experiments be given such a high priority that they dominate the payloads? Will high paying corporate projects utilize any remaining space? Will there be any opportunities at all for high school and college students? What will be the nature of such opportunities? These and other questions will be discussed.

IP-15 ONE HIGH SCHOOL STUDENT'S EXPERIENCE IN THE STUDENT SHUTTLE INVOLVEMENT PROJECT, Charles W. J. Scaife and S. Richard Cavoli, Department of Chemistry, Union College, Schenectady, NY 12308

The Student Shuttle Involvement Project is a joint venture of the National Aeronautics and Space Administration and the National Science Teachers Association. Its purpose is to stimulate the study of science and engineering by high school students through a competition involving the development of experiments suitable for flight aboard the Space Shuttle. The purpose of this presentation is to describe the various phases of one student's attempt to determine whether larger, plate-like lead iodide crystals can be grown in microgravity than can be grown in the laboratory at 1 G. These phases include a preliminary proposal, constructive criticism of the proposal, a final proposal, seeking a sponsor, preliminary design of the apparatus, consultation with NASA scientists about the apparatus, final design of the apparatus, construction of the apparatus, pre-flight testing and packing, the experiment in flight, and the post-flight analysis.

IP-16 STRUCTURED CHEMICAL PROBLEM SOLVING AND BASIC. Howard P. Williams and J. Emory Howell, Department of Chemistry, University of Southern Mississippi, Hattiesburg, MS 39406-5043. Joseph L. Russell, Department of Chemistry and Physics, Alcorn State University, Lorman, MS 39096.

BASIC programming is being used as a vehicle for enhancing approaches to problem solving methods in a year long Honors Workshop for teachers of high school chemistry. Working with thirty teachers from a four state area, we have found that learning to write or modify programs can help teachers improve their own problem solving skills. The very process of structuring a program to solve a problem gives the teacher insights which help in teaching problem solving as well. As opposed to usual Computer Assisted Instruction techniques, the emphasis is on harnessing the creative and logical reasoning abilities of each teacher. Teachers with experience in BASIC programming are grouped with teachers who have had little or no experience. Participants (most with no computer programming experience) are given functional programs to modify. This program modification approach serves as a smooth entry point into structured thinking and initiates original program writing quickly. Pre and post tests are used to assess progress in developing this approach. Specific examples of chemical concepts and programs will be presented.

Tuesday, July 29, 1986
Strategies and Ideas II
275 Strand Union Building

8:00PM
Introduction
Session Chair, **Carter VB**

8:00PM
IS-09
INTRODUCING SYMMETRY IN THE HIGH SCHOOL CHEMISTRY CLASS
Carter VB

8:10
IS-10
TEACHING CHEMISTRY OFF THE WALL
Beach DH

8:25
IS-11
NONTRADITIONAL TECHNIQUES USED TO MOTIVATE HIGH SCHOOL CHEMISTRY STUDENTS
Good G

8:40
IS-12
STUDENTS SIMULATE CHEMISTS
Nickels W

8:55
IS-13
TEACHING CHEM. STUDENTS: INSIGHTS FROM THE FIELD OF COUNS. PSYCHOLOGY
Middlecamp C, Kean E

9:10
IS-14
SOME CONCRETE ANALOGIES FOR ABSTRACT CONCEPTS
Fortman JJ

9:25
IS-15
SUPPLEMENTAL INSTRUCTION FOR UNDERPREPARED STUDENTS IN INTRO CHEMISTRY
Wiesenfeld KE

9:40
IS-16
A SYSTEMS APPROACH TO TEACHING FIRST YEAR CHEMISTRY
Johnson GL, Lutton JK, Pappenhagen JM, York O Jr

9:55
IS-17
THE RESULTS OF TEN YEARS OF WORKSHOPS FOR HIGH SCHOOL AND ADVANCED PLACEMENT CHEMISTRY TEACHERS
Ealy Jr JL, Bowen-Ealy J

10:10
IS-18
CONTINUOUS VARIATION EXPERIMENTS AS AN INSTRUCTIONAL TOOL FOR LIMITING AND EXCESS REAGENT PROBLEMS
Schultz EL

IS-09

INTRODUCING SYMMETRY IN THE HIGH SCHOOL CHEMISTRY CLASS

Virginia B. Carter, Southern Illinois U. at Edwardsville
Edwardsville, Illinois 62026-1652

A teaching workshop will be presented on the determination of symmetry elements and unit cells in one-, two-, and three-dimensional space. The symmetry and shape of ions and molecules and polarity will be related to problems of filling space, or the solid state. Inclusion of an expanded or enrichment unit of symmetry in a high school chemistry course will offer a better understanding of the crystalline state.
Symmetry in one- and two-dimensional space will be illustrated with readily available visual aids. Mirror and glide planes and rotation axes will be discussed along with translational symmetry or the unit cell. Extensions to three dimensions will relate symmetry to molecular models and to crystal systems.

IS-10

TEACHING CHEMISTRY OFF THE WALL.

Darrell H. Beach, Eugene C. Eppley Chairholder and Master Instructor of Chemistry,
The Culver Academies, Culver, IN 46511

Most teachers at the secondary level do not take full advantage of the bulletin boards in their classrooms. This presentation will give some hints and methodologies for using bulletin boards to teach as well as to entertain. Some of the central themes which have been used by the presentor over the last decade will be presented. Some selected slides of some favorites will be illustrated and addressed. In addition a display bulletin board will be made. Ample handouts will be furnished each participant. The session should be provocative. The presentor will show that given the proper incentive and hints, teachers can be creative with that space on the wall. It need not be wasted.

IS-11 NONTRADITIONAL TECHNIQUES USED TO MOTIVATE HIGH SCHOOL CHEMISTRY STUDENTS.

Gladys Good, Arlington High School, Indianapolis, Indiana 46226

The average high school chemistry student has high aspirations but he has difficulty grasping the abstract. He is TV oriented, expecting everything to be packaged for his instant "adsorption". Yet, he can be challenged to react by being confronted with activities that involve chemistry and his world. I plan to discuss some activities I use that involve the special interests of my students. These include: debates and trials involving chemistry and society; skits highlighting chemical events; songs that put chemical facts to music., We use commercial products in the laboratory; hold cooking contests, etc. It takes time and effort to build a repertoire of events to spring on the students when the chemistry textbook loses its appeal. The students do research, master the chemical facts or techniques of the events and learn chemistry in the process.

IS-12 STUDENTS SIMULATE CHEMISTS.

William Nickels, Department of Chemistry, Schoolcraft College, 18600 Haggerty Road, Livonia, MI 48152.

Each experiment used at Schoolcraft College has an expressed purpose and programed conclusions that answer the expressed purpose. The programed conclusions break down a complicated calculation or thought into a set of progressive steps.

Experiments are introduced during the preceding lecture and are never explained prior to completion. Since the expected conclusions are unknown to the students, they find that they must collect and process their own data and formulate personal logical conclusions that may be different than other logical conclusions formulated by other students. In order to encourage intellectual honesty, all logical conclusions are accepted for credit.

This approach will be exampled by several original unpublished experiments that utilize common materials like nails, pond water, and commercial rust remover.

IS-13 TEACHING CHEMISTRY STUDENTS: INSIGHTS FROM THE FIELD OF COUNSELING PSYCHOLOGY

Catherine Middlecamp & Elizabeth Kean
Chemistry Tutorial Program
1101 University Avenue
University of Wisconsin-Madison
Madison, WI 53706

At the heart of teaching is people - teachers and learners. People use language, both verbal and nonverbal, in the process of teaching and learning. Using insights from counseling and educational psychology, I will provide practical hints about communication in the teaching/learning process. This information can be applied both to your own teaching and to your training and supervision of TA's. Topics will include: "powers of observation," "teacher as chameleon," "knowing the use of no," "if you are not getting the results that you want...," and "the more things change, the more they stay the same."

IS-14 SOME CONCRETE ANALOGIES FOR ABSTRACT CONCEPTS.

John J. Fortman, Dept. of Chemistry, Wright State University, Dayton, Ohio 45435

Many students in general chemistry are stillin the transition from the concrete operational to the formal operational mode of reasoning. As such analogies to concrete observables may help the student grasp abstract concepts. An often used example is the comparison of quantized states to stairsteps in contrast to non-quantized properties as an inclined plane. Some analogies will be illustrated which have been helpful in explaining such topics as the frequency of light, electron flow in series or parallel, evaporation of solvents, manometers, electron screening, polymerizations, systematic nomenclature, structural isomers of hydrocarbons, and hybridization and normalization of orbitals.

IS-15 SUPPLEMENTAL INSTRUCTION FOR UNDERPREPARED STUDENTS IN INTRODUCTORY CHEMISTRY

Kathleen E. Wiesenfeld, LSC/Chemistry, Baker Laboratory, Cornell University, Ithaca, New York 14853

The Learning Skills Center, begun as part of Cornell University's program for assistance to racial minority students, and the Chemistry Department jointly offer supplemental instruction for underprepared students enrolled in Chemistry 207-208, a two semester sequence of general chemistry taken by science majors. The supplemental course, Chemistry 007-008, a one credit hour per semester course, meets weekly in an evening session and provides regular office hours. Its goals are: to help students survive freshman chemistry; to decrease unfounded anxiety concerning chemistry; and to improve performance in future science courses. In contrast to other, more conventional, tutorial services that provide help with problem solving, Chem 007-008 teaches time efficient study methods, based on learning theory concepts, in the context of the Chemistry 207-208 material. To be described are the major study methods taught, and the process used to apply them to the parent chemistry course. Problems and achievements in the supplemental course will be discussed.

IS-16 A SYSTEMS APPROACH TO TEACHING FIRST YEAR CHEMISTRY.

G. L. Johnson, J. K. Lutton, J. M. Pappenhagen, and O. York, Jr., Department of Chemistry, Kenyon College, Gambier, OH 43022

An experimental approach to the teaching of first year chemistry is being developed for those students who have a strong high school preparation. The fundamental principles of chemistry are presented within the framework of an integrated study of a central problem. A few of the central problems or systems around which the course is built are: properties of water and nonaqueous solvents, energy, polymers, agricultural chemistry, metallurgy and metalloids.

IS-17 THE RESULTS OF TEN YEARS OF WORKSHOPS FOR HIGH SCHOOL AND ADVANCED PLACEMENTS CHEMISTRY TEACHERS. James L. Ealy, Jr. and Julie Bowen-Ealy, The Hill School, Pottstown, PA 19464

Workshops that do not necessarily emphasize chemical knowledge have been offered for ten years with excellent results. The participants are not given the "chemistry course" but are given ideas upon which to plan and develop their own high school programs relevant to their background and student population. Emphasis on methodology that will allow the teacher/participant to utilize his or her individual background with the types of students and the curriculum available at that school. The results, after ten years, show that teachers can present chemistry is a successful manner, using the pedagogy developed in our workshops. The major topics covered will center around laboratory experiments, books (texts, problem, supplemental), syllabus, demonstration, safety, and left/right brain learning and teaching styles. The results will be available and distributed as handouts.

IS-18

CONTINUOUS VARIATION EXPERIMENTS AS AN INSTRUCTIONAL TOOL FOR LIMITING AND EXCESS REAGENT PROBLEMS. E. L. Schultz, Marblehead High School, Marblehead, MA 01945

Continuous variation experiments lend themselves to a many interpretations as a group of students act collectively as a chemist. Use of temperature changes, color changes, precipitation formations in a structured experiment help students understand the concept of stoichiometry with an appreciation of the unique combining capacity of a particular set of reactants.

Wednesday, July 30, 1986
Practical Applications of Physical Chemistry
Strand Union Ballroom - B

8:30AM
Introduction
McClelland A, Session Chair

8:35
PH-01
PHYSICAL CHEMISTRY: FACT--A PRACTICAL UTILITARIAN COURSE; PERCEPTION--?
McClelland A

9:00
PH-02
COUPLED PHYSICAL AND CHEMICAL EFFECTS--THE MOST INTERESTING CHEMISTRY
Tolman CA

10:00
PH-03
POLYMER PRINCIPLES DO FIT INTO UNDERGRADUATE PHYSICAL CHEMISTRY
Sperling L

11:00
PH-04
CHEMICAL MICROENGINEERING: WHAT, IF ANYTHING, HAS IT TO DO WITH PHYSICAL CHEMISTRY?
Rony P

PH-01 PHYSICAL CHEMISTRY: FACT--A PRACTICAL, UTILITARIAN COURSE; PERCEPTION--? A. L. McClelland, Central R&D Dept., Du Pont Co., Wilmington, DE 19898

Physical chemistry, truly a core course in the education of chemists, chemical engineers, and (ideally) many other scientists, covers concepts of great importance in practical application of science at both laboratory and commercial level. Students often fail to perceive that utility. Recognizing this dichotomy, the ACS Education Committee has sponsored development of a spectrum of suggestions for illustrating the practical use of physical chemistry concepts which can be worked into courses without significant disruption of present course formats. A "sourcebook" of these techniques is being prepared for ACS publication; plans for this will be outlined, and subsequent speakers in this symposium will give examples.

PH-02 THE COUPLING OF PHYSICAL AND CHEMICAL EFFECTS -- THE MOST INTERESTING THINGS IN CHEMISTRY. Chadwick A. Tolman, Central R&D Dept., Bldg. 328, Expt. Station, Du Pont Co., Wilmington, DE 19898.

The world is full of interesting phenomena which involve coupling of physical and chemical effects. Come and find out how we propose to inspire students to see the physical chemistry which is all around and in them. We'll include sample problems you can use.

PH-03 POLYMER PRINCIPLES DO FIT INTO THE UNDERGRADUATE PHYSICAL CHEMISTRY COURSE.

L. E. Sperling, Dept. of Chemical Eng. and Materials Res. Ctr., Lehigh U., Bethlehem, PA 18015

Polymers, both the synthetic products of industry and the natural forms which govern all life, are crucially important molecules, yet are often given rather sketchy treatment in the chemistry curricula. The ACS Polymer Education Committee, a joint effort of the Polymer Chemistry and Polymeric Materials Science and Engineering Divisions, has therefore developed suggestions for ways that more polymer chemistry can be incorporated into existing courses. Recommendations of the subcommittee which developed such suggestions for the physical chemistry core course will be summarized. The presentation will include ways to use polymer examples in existing course segments, sample exam questions, and demonstrations. Emphasis will be on inclusion of polymer material without disruption of usual course structure.

PH-04 CHEMICAL MICROENGINEERING: WHAT, IF ANYTHING, DOES IT HAVE TO DO WITH PHYSICAL CHEMISTRY?

Peter R. Rony, Dept. of Chemical Eng., Virginia Polytech. Inst. & State U., Blacksburg, VA 24061

A wonderful opportunity exists to tie the subjects of chemical kinetics, chemical reactors, chromatography, diffusion-controlled reactions, equilibrium separations, etc. into an efficiently taught, unifying whole that can be comprehended by juniors in a physical chemistry course. The basis for this unification is the conservation-of-species equation (also called the continuity-of-species equation), which has been used for more than half a century by scientists and engineers who encounter practical situations in which simultaneous transport, reaction, and equilibrium occur in chemical systems.

Wednesday, July 30, 1986
About Demonstrations
275 Strand Union Building

9:00AM
Introduction
Session Chair, **Karg J**

9:05
DE-15
WRIGHT STATE'S DEMONSTRATION SHOWS
Fortman JJ, Battino R

9:25
DE-16
ICE CATALYSIS: REPORT ON ACTIVITIES OF THE INSTITUTE FOR CHEMICAL EDUCATION
Perkins RI, Dirreen GE

9:45
DE-17
DEMONSTRATIONS TO HELP BUILD MENTAL MODELS OF CHEMISTRY CONCEPTS
Wright SM, Andrews OA

10:05
DE-18
A CHEMISTRY MAGIC SHOW FOR GRADES 5-8
Christoph MS

10:25
DE-19
SMOKE, MAGIC, MIST AND FIRE... CHEMICAL PRINCIPLES BY DEMONSTRATION
Houk CC

10:45
DE-20
TIPS AND KITS FOR CHEMISTRY DEMONSTRATIONS
Gilbert GL

DE-15 WRIGHT STATE'S DEMONSTRATION SHOWS. John J. Fortman and Rubin Battino, Dept. of Chemistry, Wright State University, Dayton, Ohio 45435

For the last three years Wright State's chemistry department has offered a chemical demonstration show for students in the high schools, junior highs, and middle schools in an eight county region. This year the program has grown to 15 shows given to 7500 students. Eight of the shows were on campus for combined audiences of smaller groups and seven were shows done at the schools. Ten other schools are on our waiting list for road shows next year. The purpose of the shows are to illustrate the fun and wonder of chemistry and learning by experimentation, while teaching students to distinguish between chemical and physical changes. Photographs from the shows along with a list of 30 plus demonstrations used will be posted along with copies of the handouts given to students and teachers. If a VCR and monitor are available a tape of the program will be shown.

DE-16 ICE CATALYSIS: REPORT ON ACTIVITIES OF THE INSTITUTE FOR CHEMICAL EDUCATION.

R.I. Perkins, Greenwich High School, Greenwich, Connecticut 06830;
G.E. Dirreen, Department of Chemistry, University of Wisconsin-Madison, Madison, Wisconsin 53706.

During the summers of 1984-5 and 6 more than 800 precollege teachers participated in ICE workshops held at the Universities of Arizona, California-Berkeley, Maryland and Wisconsin-Madison. The 24 workshops brought together an unprecedented combination of teachers of different talents, experience and interests. Elementary and secondary school teachers worked side-by-side with one another and with national leaders in chemistry and chemical education. Workshops emphasized a "hands on, minds on, seeing it, doing it, understanding it" approach to teaching and learning of chemistry topics. A report on the summer workshops and other ICE activities will be presented and illustrated.

DE-17 DEMONSTRATIONS TO HELP BUILD MENTAL MODELS OF CHEMISTRY CONCEPTS

S.M. Wright, O.A. Andrews; Chemistry Department University of Wisconsin-Stevens Point Stevens Point, WI 54481

In the summer of 1985, a workshop on visualizing chemistry was held for high school chemistry teachers. Demonstrations developed at this workshop were primarily non-chemical analogies to help students build mental models of abstract concepts. This talk will focus on a few new activities developed at this workshop.

DE-18 A CHEMISTRY MAGIC SHOW FOR GRADES 5-8.

Margaret S. Christoph, St. Mark's High School, Wilmington, DE 19808

In this presentation, a magic show that was prepared and presented by members of my A.P. Chemistry class for grade school students will be described. Demonstrations were selected on the basis of safety, illustrating scientific concepts, and stimulating interest. A number of household chemicals were used in an effort to show that chemical can be "good", desirable, and necessary. The experiments will be illustrated using transparancies on the overhead and a handout will be available.

DE-19 SMOKE, MAGIC, MIST AND FIRE...CHEMICAL PRINCIPLES BY DEMONSTRATION.

Clifford C. Houk, Department of Chemistry, Ohio University, Athens, Ohio 45701-2979.

This course was developed and presented at the request of Ohio University students through their University Professor program that recognizes outstanding teaching abilities and effective insight into the educational process. Enrollment was open to any student at Ohio University. The only prerequisite was an interest in those chemicals students encounter during their day to day existence. The fifty-three self-selected participants were from all class ranks majoring in chemistry, finance, telecommunications, psychology, political science, journalism, engineering, creative writing... 24 different majors in all. The course purpose, goals, content, format and results will be presented with a recommendation how such a course might be used as a general education multidisciplinary liberal arts, senior level capstone or synthesis offering.

DE-20 TIPS AND KITS FOR CHEMISTRY DEMONSTRATIONS

George L. Gilbert, Department of Chemistry, Denison University, Granville, OH 43023

A variety of organizational techniques and useful shortcuts have been developed to allow easy use, repetition and cleanup of materials required for chemical demonstrations. Those techniques and shortcuts used by the author will be shared with the hope that audience input will generate more ideas for participants. A major focus will be on the use of pre-packaged kits as a time-saving device.

Wednesday, July 30, 1986
Teaching Inorganic Chemistry
234 Gaines Hall

8:30AM
Introduction
Session Chair, **Manahan S**

8:35
IN-01
GENERAL VS DESCRIPTIVE VS INORGANIC CHEMISTRY
Crawford VH

8:55
IN-02
USE OF CRYSTALLOGRAPHIC COORDINATES TO TEACH INORGANIC CHEMISTRY
Lisensky GC

9:15
IN-03
THE BATTLE OF ARMAGEDDON: ONE DEPARTMENT'S RESPONSE TO ACS/CPT TWO SEMESTER INORGANIC CHEMISTRY GUIDELINE
Burmeister JL

9:35
IN-04
A SOPHOMORE-LEVEL PRINCIPLES-ORIENTED DESCRIPTIVE INORGANIC COURSE AND TEXTBOOK
Wulfsberg GP

9:55
IN-05
APPLIED DESCRIPTIVE INORGANIC CHEMISTRY: EARNING MAXIMUM INTEREST ON CHEMICAL PRINCIPLES WITH AN INTEGRATED APPROACH
Manahan SE

10:15
IN-06
WHAT INORGANIC CHEMISTRY SHOULD A GENERAL CHEMISTRY STUDENT KNOW?
Crump JW, **Gaswick GC**, Steffenson DM

10:35
IN-07
PREDICTING PRODUCTS OF A CHEMICAL REACTION
Crump JW, **Gaswick DC**, Steffenson DM

IN-01 GENERAL VS DESCRIPTIVE VS INORGANIC CHEMISTRY. Van H. Crawford, Department of Chemistry, Mercer University, Macon, Georgia 31207

In the "good old days," General Chemistry contained a large dose of descriptive chemistry and this was the major emphasis of Inorganic Chemistry. Currently General Chemistry contains very little descriptive chemistry and Inorganic has developed into an exciting growing field that goes far beyond descriptive chemistry. The "silver chloride is a pale green gas" problem has not been resolved and now there is the two semester Inorganic Chemistry guideline. We have developed a one quarter "Descriptive Chemistry" course that follows P. Chem. The content of the course is largely that which is included in one of the descriptive chemistry supplements available for general chemistry texts, but the sophistication of the students allows for interesting discussions. There is also the advantage of being able to offer a true "Advanced Inorganic" course, with the descriptive course as a prerequisite. The advantages of this course and associated laboratory will be discussed.

IN-02 USE OF CRYSTALLOGRAPHIC COORDINATES TO TEACH INORGANIC CHEMISTRY
George C. Lisensky, Chemistry Dept, Beloit College, Beloit, WI 53511

Crystallography yields the coordinates of atoms but does not show bonds. Bonds must be inferred by the distance between the atoms as well as the elements involved. We assign students in the first inorganic course to each take the coordinates, unit cell, and space group symmetry from a different published crystallographic paper and to use a crystallographic plotting program to draw a picture of the molecule. Organometallic compounds, where the variation in valences with oxidation state sometimes makes the bonding quite debatable, are especially challenging. Students learn that telling the program to draw bonds to all atoms closer than typical metal-metal bond distances results in carbon atom second nearest neighbors being connected. Production of a clear picture of their assigned molecule requires students to use their knowledge of symmetry, knowledge of chemical bonding, spatial visualization qualities and even some artistic ability.

IN-03 THE BATTLE OF ARMAGEDDON: ONE DEPARTMENT'S RESPONSE TO THE ACS/CPT's TWO SEMESTER INORGANIC CHEMISTRY GUIDELINE. John L. Burmeister, Department of Chemistry, University of Delaware, Newark, DE 19716.

Opposition to the implementation of the new ACS/CPT two semester inorganic chemistry guideline in our curriculum was vehement, vocal, and divided into two camps. The "If Harvard Doesn't Do It" group was generally opposed to the entire concept of an ACS-certified undergraduate chemistry curriculum. The "Turn Back the Clock" camp was opposed to the inclusion of any required inorganic chemistry course in the curriculum, reasoning that inorganic chemistry consists of a series of special topics, of interest only to specialized groups. The other extreme was represented by the "Equal Rights, Equal Time" group, who argued that the time had come for inorganic chemistry to assume its rightful two semester, post-general chemistry position in the curriculum, along with organic, physical, and analytical chemistry. The majority point-of-view, however, was articulated by the "Sanctity of Free Electives" group, who successfully argued that the 27 hours of free electives, representing 21% of our ACS-certified B.S. curriculum must remain intact. Accordingly, we have incorporated the CPT-mandated second required semester of "basic" inorganic chemistry into our chemistry/chemical engineering majors' general chemistry course. This paper will describe the major revision that this entailed, given the fact that the occurrence, properties, preparation, reactions and uses of the elements and their compounds had largely been ignored with in this course for two decades.

IN-04 A SOPHOMORE-LEVEL PRINCIPLES-ORIENTED DESCRIPTIVE INORGANIC COURSE AND TEXTBOOK. Gary P. Wulfsberg, Department of Chemistry and Physics, Middle Tennessee State University, Murfreesboro, TN 37132.

An alternative is described to the usual presentation of descriptive inorganic chemistry as a group-by-group collection of facts to be memorized by students. Our post-General Chemistry course and textbook has a principles-oriented organization of descriptive inorganic chemistry according to property and reaction types and classes of compounds, in much the manner in which modern organic chemistry is presented. This allows a better presentation of both the inorganic principles and the descriptive chemistry suggested by the Division of Inorganic Chemistry for such a course, since (1) many actual reactions and properties can be used as concrete examples for the principles covered, and (2) the principles can first be "discovered" by students from lab experiments or classroom demonstrations included in the text. Students learning from this approach have scored far above the national mean on the Inorganic portion of the Graduate Record Exam. The textbook will be published by Brooks-Cole in February 1987.

IN-05 APPLIED DESCRIPTIVE INORGANIC CHEMISTRY: EARNING MAXIMUM INTEREST ON CHEMICAL PRINCIPLES WITH AN INTEGRATED APPROACH. Stanley E. Manahan, Department of Chemistry, 123 Chemistry Building, University of Missouri, Columbia, Missouri 65211.

For some time the need has been recognized to integrate descriptive inorganic chemistry with principles in the introductory college, and high school chemistry courses. An approach is presented that makes use of applied chemistry for this purpose. Applied chemistry with examples from industrial products and processes, environmental/toxicological chemistry, agricultural chemistry, "high-technology," and various other areas can be used to teach descriptive inorganic chemistry along with principles. An important benefit of this approach is enhanced student interest that comes with emphasizing areas in which students can see the importance of chemistry in industry, society, and their own lives.

IN-06 WHAT INORGANIC CHEMISTRY SHOULD A GENERAL CHEMISTRY STUDENT KNOW? John W. Crump, Dennis C. Gaswick, and Daniel M. Steffenson, Department of Chemistry, Albion College, Albion, MI, 49224.

A complete answer to the title question cannot be given nor would all chemists agree on a particular set, but it is a question that should be asked when designing a general course that includes descriptive chemistry. While we would not agree on all the answers we would probably agree that a student should develop a feel for the differences among compounds such as NaCl, $SiCl_4$ and FCl, especially the reactions of these compounds with water. The student should be able to use periodic properties and trends in structure to predict reasonable formulas for binary compounds, and to use electronegativities and redox potentials to predict reasonable chemical behavior without having to memorize each reaction. Common exceptions to reasonable predictions should be recognized (a student can reasonably predict SO, but they should know that it doesn't form). In a typical approach to descriptive chemistry, each element or group of elements is investigated separately. Our approach is to take each reaction or property individually and look at the periodic trends associated with it. We will discuss what we expect the student to know and how we designed our course to accomplish those goals.

PREDICTING PRODUCTS OF A CHEMICAL REACTION. John W. Crump, Dennis C. Gaswick, and IN-07 Daniel M. Steffenson, Department of Chemistry, Albion College, Albion, MI, 49224

One of the most difficult tasks for a student is to predict the products for a given reaction. The development of the skills necessary to recognize various types of reactions is not easy and it requires a systematic approach in analyzing the reactants. In our course we have the students first develop the ability to predict reasonable formulas for compounds and then to use these formulas as a basis for predicting products of a reaction. Acid-base reactions are covered first using Lewis acid-base concepts and relative electronegativities as a basis for predicting reasonable products. The student learns to predict formulas such as $P(OH)_3$ and $PO(OH)_3$, and then uses that information to predict the products of reactions such as P_4O_{10} or PCl_3 reacting with water. For redox reactions the use of EMF diagrams in predicting stability of oxidation states in water and in predicting the spontaneous reaction between two reactants is developed. The periodic trends of stable oxidation states and of relative oxidizing and reducing strengths is then discussed. This poster will have specific examples of the approach used. A general scheme that the student can use to predict reasonable products for a given set of reactants will also be presented.

Wednesday, July 30, 1986
Computer Hands-on III
276 Strand Union Building

9:00-11:30AM

CH-16
KINETIC MECHANISM MODELING ON THE MACINTOSH
Kooser RG, Ditchfield R

CH-17
ANIMATED INTERACTIVE SIMULATIONS OF CHEMICAL PHENOMENA ON MICROCOMPUTERS: BY AND FOR STUDENTS
Julien LM

CH-18
DISPLAYING TITRATION CURVES ON AN APPLE IIE WITH THE ADALAB(TM) INTERFACE BOARD AND INTERFACING UTILITY PROGRAMS
Juergens F, Gelder JI, Sellin S

CH-19
PARTICIPATIONAL FICTION IN EDUCATION
Williams FD

CH-20
COMPUTER SIMULATION OF ADVANCED INSTRUMENTATION
Rittenhouse RC

CH-21
COMPUTER-BASED MOLECULAR GRAPHICS FOR LEARNING MOLECULAR STRUCTURE
Smith AL

CH-22
SO YOU ONLY HAVE ONE COMPUTER
Bogner D

CH-23
COMPUTER ASSISTED BLACKBOARD
Soltzberg LJ

CH-16 KINETIC MECHANISM MODELING ON THE MACINTOSH. R.G. Kooser, Knox College, Galesburg, IL 61401; R. Ditchfield, Dartmouth College, Hanover, NH 03755.

The use of a new equation solving program for the Macintosh called STELLA. makes it possible to solve complex differential equations involved in kinetic mechanisms. (Since the program can be used in an iconograph mode, it is possible to use it even in general chemistry.) The program can be run in an iconograph mode so that the equations can be modeled without any knowledge of differential equations. This makes it possible to use the program in general chemistry. Several examples will be offered on the use of the program.

CH-17 ANIMATED INTERACTIVE SIMULATIONS OF CHEMICAL PHENOMENA ON MICROCOMPUTERS: BY AND FOR STUDENTS. Dr. Larry M. Julien, Department of Chemistry and Chemical Engineering, Michigan Technological University, Houghton, Michigan 49931.

Interactive, animated simulations and games have been created by students in classes ranging from freshman chemistry to special senior projects. Some of the creations are used in lectures to illustrate chemical phenomena and concepts. Others are intended to be used by students on an individual basis.

The developmental processes all varied, but one characteristic stood out above all others. A vast majority of the students became highly motivated to learn and understand the objects of their computer simulations, resulting in enhanced learning and understanding of chemistry.

Demonstrations of the results of these projects and discussion of the developmental processes will be covered at the presentation.

CH-18 DISPLAYING TITRATIONS CURVES ON AN APPLE IIE WITH THE ADALAB(TM) INTERFACE BOARD AND INTERFACING UTILITY PROGRAMS, F.J.Juergens, Department of Chemistry, University of Wisconsin-Madison; J.I.Gelder, Department of Chemistry, Oklahoma State University; S.Sellin, Department of Manufacturing Systems Engineering, University of Wisconsin-Madison.

Software has been developed to interface a pH meter through the ADALAB(tm) interface board to an Apple IIe. During an acid-base titration, values for pH readings vs. volume of added titrant are plotted on the monitor screen. Data from several titrations may be stored, recalled and re-plotted on the same axis set. The system will be demonstrated. Possible extensions to other chemical instrumentation will be discussed.

CH-19 PARTICIPATIONAL FICTION IN EDUCATION - Fred D. Williams, Department of Chemistry and Chemical Engineering, Michigan Technological University, Houghton, Michigan 49931

The most popular type of recreational program for microcomputers is called participatory fiction. The player assumes the role of a character in, for example, a mystery novel and attempts to solve the mystery by looking for clues, interrogating suspects, setting traps, etc. The key to the success of these programs is that the player is in control of the action. S/he communicates with the computer, which controls the plot(s) and the ramifications of each action, with simple English commands and the computer responds appropriately.

We have used this popular format in education by writing "plots" which require the solution of scientific problems. For instance, rather than the determination of a murderer, 3 educational games in chemistry by the author require the determination of the identity of an unknown polymer sample, or the synthesis of a series of organic molecules or the safe use and disposal of toxic materials. These and other educational participatory fictions will be described and will be available for examination.

CH-20 COMPUTER SIMULATION OF ADVANCED INSTRUMENTATION. R.C. Rittenhouse, Department of Chemistry, Eastern Michigan University, Ypsilanti, MI 48197.

It is difficult or impossible for many chemistry departments to systematically train undergraduates in the use of sophisticated instrumentation like NMR or HPLC. Operation of these instruments involves a significant learning curve requiring supervised hands-on training. It is very costly to provide such access to students on a routine basis.

It is possible to design a computer simulation of an instrument which behaves much like the real thing in terms of operating procedures and instrument response. Such simulations provide easy, inexpensive access to many of the features of the real instrument without risk of damage, consumption of supplies, and the need for constant supervision. Simulations are also pedagogically efficient, due to their speed and reliability, in exposing students to a wide range of experimental situations.

An HPLC simulation has been conceived and developed under the sponsorship of project SERAPHIM. This simulation will be examined in detail to illustrate the potential of such programs.

CH-21 COMPUTER-BASED MOLECULAR GRAPHICS FOR LEARNING MOLECULAR STRUCTURE. Allen L. Smith, Chemistry Department, Drexel University, Philadelphia, PA 19104

The venerable idea that molecules have a three-dimensional structure is one of the central notions in chemistry. Molecular graphics can help students bridge the gap between the ball-and-stick model and the more abstract ways chemists represent structure in two dimensions. **Molecular Editor**, a software-based construction kit for the Apple Macintosh, will be described. You can build or edit molecules and crystals of over 100 atoms from any element in the periodic table, atom by atom or from predefined functional groups. You can draw structures as all atoms and all bonds, atoms only, or bonds only. You can change the perspective from which the molecule is seen, rescale the molecule, or independently rescale atomic radii while leaving bond lengths unchanged, allowing continuous variation from a space-filling model to a bonds-only model. You can rotate a molecule through any angle about any axis, and you can rotate or move a portion of a molecule with respect to another portion. Group theory operations such as inversion and reflection through planes are available. With screen operations you can measure the distance between any two atoms, the angle between two bonds, and the torsional angle about a bond. You can store and retrieve structures on disk, with up to 20 files open at one time. On a 512 k Mac, you can run through a sequence of open files rapidly (5 frames/sec) using an animation feature. Sample files of organics, functional groups, inorganics, crystals, simple geometric shapes, and animations of chemical reaction in 3-D have been developed. Use of this software with undergradautes will be described.

CH-22 SO, YOU ONLY HAVE ONE COMPUTER..., Dr. Donna Bogner, Box 51, Wichita State University, Wichita, KS 67208.

Microcomputers are not textbooks or lab manuals; you do not need one for each student. This presentation will demonstrate the use of ONE computer as a lecture aide, a demonstration tool, and as a data-collection device using free and inexpensive software, to help students visualize abstract concepts, concentrate on the results of changing parameters, and collect quantitative data in the classroom setting.

Free and inexpensive software that can be used to introduce and/or amplify the concepts of moles, random occurences, atomic structure and size of atoms and ions, changing gas law and reaction rate parameters. Handout materials will contain background information and documentation for use of the software.

CH-23 THE COMPUTER-ASSISTED BLACKBOARD. Leonard J. Soltzberg, Chemistry Department,
Simmons College, 300 The Fenway, Boston, MA 02115.

The Computer-Assisted Blackboard is an in-class lecture aid intended for use by the instructor rather than by the students. It serves as an adjunct to a conventional blackboard by allowing the lecturer to illustrate dynamic processes as opposed to static objects.

The software is not based on a script. Rather, it provides a collection of objects and processes which can be drawn, erased, and otherwise controlled to fit the presentation being made. Use of modular program design and compiled BASIC yields satisfactory speed for various animations.

Use of this technique was demonstrated Monday morning in Teaching Chemistry Using Computers (abstract #CC-04). This second scheduling is to provide some hands-on experience for participants.

Wednesday, July 30, 1986
Quantitative Lecture-Hall Experiments
101 Gaines Hall

1:00PM
Introduction
Session Chair, **Gelder J I**

1:05
DQ-12
A THERMODYNAMICS STUDY
Koubek E

1:05
DQ-13
MEASURING CHANGES IN MASS DUE TO OSMOSIS IN A DECALCIFIED EGG
Shaw DB

1:05
DQ-14
A CHEAP AND EASY WAY OF DETERMINING THE MOLECULAR WEIGHT OF AN UNKNOWN GAS
Bodner GM

1:05
DQ-15
LASER-AIDED DETERMINATION OF THE STABILITY CONSTANT OF THE SILVER AMMINE COMPLEX
Brooks DW, Lyons E

1:05
DQ-16
A CATALYST IN ACTION
Bowen-Ealy J

1:05
DQ-17
THE LAW OF CONSERVATION OF MASS or MORE THAN MEETS THE EYE
Perkins RI

DQ-12 A THERMODYNAMICS STUDY. E. Koubek, U.S. Naval Academy, Annapolis, MD

This experiment illustrates how one can obtain the thermodynamic properties of a substance. By following the equilibrium pressure of NH_3 and CO_2 at different temperatures, students can calculate ΔG°_T, ΔH, ΔS, ΔE for the reaction

$$NH_4CO_2NH_{2(s)} \rightarrow 2NH_{3(g)} + CO_{2(g)}$$

From these, values of ΔG°_f, ΔH°_f and ΔS°_{298} for $NH_4CO_2NH_{2(s)}$ may be determined.

The apparatus that will be demonstrated is of the authors own design. The audience will be encouraged to collect their own data. A discussion of the results obtained will be presented on the last day of the symposium.

DQ-13 MEASURING CHANGES IN MASS DUE TO OSMOSIS IN A DECALCIFIED EGG.

David B. Shaw, The Institute for Chemical Education, University of Wisconsin–Madison, Madison, WI 53706

Raw eggs are soaked in vinegar for two to three days to dissolve the shell. One egg is placed in distilled water, while a second egg is placed in a concentrated solution of glucose or Karo™ syrup. Mass measurements are taken every 15 minutes over the length of a class period. The egg loses or gains at least one percent of its mass due to the membrane being semi-permeable.

DQ-14 A CHEAP AND EASY WAY OF DETERMINING THE MOLECULAR WEIGHT OF AN UNKNOWN GAS.

G. M. Bodner, Department of Chemistry, Purdue University, West Lafayette, IN 47907.

A classic way of determining the molecular weight of an unknown compound involves adding a small volume of a volatile liquid to a "Dumas" flask, inserting the flask in boiling water until the liquid vaporizes and fills the flask, and then determining the weight of gas that fills the flask at the temperature of boiling water. A cheaper and easier way of measuring the molecular weight of a gas can be demonstrated with a butane lighter fluid can and a tire pressure gauge. A vacuum pump is used to evacuate the can, and the weight of the "empty" can is measured on an analytical balance. The can is then connected to a compressed gas cylinder and filled to 2-3 atmospheres pressure. The can is then weighed, and the pressure of the gas in the can is measured with a tire pressure gauge. A small amount of gas is allowed to escape and the measurements are then repeated. With practice, up to 30 measurements can be obtained on a single trial. The pressure versus weight data are then plotted and extrapolated to determine the weight at 0 psi (1 atm pressure). Known values of atmospheric pressure and temperature are then combined with the volume of the lighter fluid can (4 fluid ounces) to calculate the number of moles of gas. The ratio of the mass at 0 psi to the number of moles gives the molecular weight.

DQ-15 LASER-AIDED DETERMINATION OF THE STABILITY CONSTANT OF THE SILVER AMMINE COMPLEX.

D. W. Brooks, University of Nebraska, Lincoln, NE 68588-0355 and E. J. Lyons, Lincoln East HS, Lincoln, NE 68510.

A dilute solution of aqueous sodium chloride is titrated with dilute aqueous silver nitrate to the appearance of "red pencil lead" of scattered HeNe laser light. From the data available, a reasonable estimate of the solubility product constant for silver chloride may be calculated. A nine-fold excess of silver solution, by volume, is added. Dilute ammonia is added to the disappearance of the lead pencil. From the data available, the stability constant of the silver ammine complex is calculated.

DQ-16 A CATALYST IN ACTION.

Julie Bowen-Ealy, The Hill School, Pottstown, PA 19464

A clear solution of sodium potassium tartrate and hydrogen peroxide are heated to various temperatures in the presence of a catalyst, cobalt chloride. The reaction will proceed at various rates, directly proportional to the temperature. However, the activated complex formed with the cobalt is a forest green color and contrasts well. The cobalt ion gives a pink color upon addition and then disappears as the green complex is formed and then returns as the reaction is completed.

DQ-17 THE LAW OF CONSERVATION OF MASS or MORE THAN MEETS THE EYE

R. I. Perkins, Institute for Chemical Education, Department of Chemistry, University of Wisconsin, Madison, Wisconsin 53706

Often the "simple" is more complex than at first thought. This demonstration of a fundamental law generates much thought-provoking discussion.

Wednesday, July 30, 1986
JCPDS-ICDD X-Ray Analysis
Strand Union Ballroom - D

3:00PM
Introduction
Session Chair, **McCarthy GJ**

3:05
WX-01
THE SHROUD OF TURIN: A REVIEW OF THE CURRENT EVIDENCE
Jenkins R

4:00
Discussion

WX-01 INTRODUCTION TO JCPDS-ICDD WORKSHOP ON X-RAY ANALYSIS. THE SHROUD OF TURIN: A REVIEW OF THE CURRENT EVIDENCE, Jenkins R.

The Shroud of Turin is a large piece of linen cloth 14' x 3'7" preserved today in a chapel attached to the Cathedral of Saint John in Turin, Italy. The Shroud is of particular interest to Christians because tradition says that the body of Christ was wrapped in this cloth at the time of his burial.

The Shroud has been put on public display many times over the years and such a display took place at the turn of the century in Turin. At this time, permission was granted to photograph the Shroud for the first time, and the result was to respark public interest.

In 1978 a group of scientists in the United States, formed a group called "STURP" (Shroud of Turin Research Project) with the idea of providing collective expertise in this area. In 1978 this group carried out a very extensive investigation of the Shroud on site in Turin, and while some of the results have been published, much of the data are still being evaluated.

The scientific, religious and social implications of this artifact combine to produce a fascinating problem which has, for a number of years, intrigued historians and scientists alike. This talk reviews the evidence available to us today from the perspective of one who is both a scientist and a born again Christian.

Wednesday, July 30, 1986
Teaching Chemistry Using Computers
Strand Union Ballroom - C

2:45PM
Introduction
Session Chair, **Rayner-Canham G**

2:45PM
CW-01
TWO USES OF MICROCOMPUTERS IN A SMALL COLLEGE ENVIRONMENT
Rayner-Canham G

3:05
CW-02
BRING IN A TROJAN MOUSE
Clevenger JV

3:25
CW-03
DYNAMICS OF A THREE-CORNERED DUEL: CREATION OF COMPUTER-BASED GENERAL CHEMISTRY COURSES
Burmeister JL

3:45
CW-04
KEEPING THE USER HAPPY: EXAMPLES AND SUGGESTIONS FOR BETTER PROGRAMS
Gable RW

4:05
CW-05
PROLOG AND ARTIFICIAL INTELLIGENCE TECHNIQUES FOR CHEMICAL EDUCATION
Cabrol D

CW-01 TWO USES OF MICROCOMPUTERS IN A SMALL COLLEGE ENVIRONMENT. Geoff Rayner-Canham, Sir Wilfred Grenfell College, Corner Brook, NF A2H 6P9, Canada.

Microcomputers are very useful tools provided their need is clearly identified. We have successfully utilized microcomputers in two roles, for writing textual materials and for a computer-assisted drill program.

Creative word processing is a tremendously powerful tool for a chemical educator, yet there is much more to it than just sitting in front of a keyboard and hitting keys. The choice of software - thought outliners, general and scientific processing systems and print enhancers - will be emphasized. Also, some chem. ed. support materials will be described.

Instructors at small colleges should be particularily clear on their need for CAI before they rush into its implementation. The design, development and testing of a small computer-assisted drill program will be described that filled a clearly-defined role. A resource handout will be available.

CW-02

BRING IN A TROJAN MOUSE. John V. Clevenger, Truckee Meadows Community College, Reno, NV 89512.

How do you bring about change in an academic environment? Specifically, how might you acquire/use microcomputers in beginning college chemistry courses? Once you get them, what might you realistically expect to do with them?

This is a history of the incorporation of microcomputers into the chemistry (and many other) courses at a medium size community college during the last five years. A description of the process should be useful as a guide for others working to begin the use of microcomputers. In a broader sense, those attempting curricular or course changes in any area should find some tactics for change.

CW-03 DYNAMICS OF A THREE-CORNERED DUEL: THE CREATION OF A COMPLETE COMPUTER-BASED GENERAL CHEMISTRY COURSE. John L. Burmeister, Department of Chemistry, University of Delaware, Newark, DE 19716.

Since it began in 1981, the development of the PLATO® general chemistry course for the Control Data Corporation's Lower Division Engineering Curriculum has resembled a three-cornered duel. The benevolent duelists for the first-semester course (Chem 1) included an Editorial Review Board, comprised of five experienced chemical educators, the Office of Computer-Based Instruction at the U. of Delaware, and the Control Data Corp. The ERB provided subject matter expertise, from the establishment of the learning objectives for each lesson (57 lessons in Chem 1), to the creation of detailed Lesson Content Descriptions, through the review of written scripts and on-line lessons. The OCBI executed all of the actual scripting and programming for each Chem 1 lesson. CDC has underwritten the cost of the project, has provided technical management, and is marketing the product. This paper will describe the pit-falls and triumphs inherent in this unique approach to lesson development, which has resulted in the creation of a complete, self-contained, computer-based first semester general chemistry course. The course is available in both main frame and micro versions, provides on-line testing capability, and is keyed to five of the most popular general chemistry texts. It can be used as an adjunct to traditional lectures, or as a replacement (with a faculty member available for consultation), and has been class-tested under both circumstances. The development of the 36 lessons comprising the second semester course, Chem 2, has now been completed, with several changes in both personnel and procedures. This paper will discuss our Chem 2 experiments with on-line script development at the U. of Alberta and lecture-based script development at the U. of Maryland.

CW-04 KEEPING THE USER HAPPY: EXAMPLES AND SUGGESTIONS FOR BETTER PROGRAMS. R.W. Gable, Department of Chemistry, Davidson College, Davidson, NC 28036.

A program intended for use by a variety of people has important requirements in addition to the essential goal of "getting the job done". Guidelines to assist authors in producing attractive, usable, and effective programs have been suggested by Project SERAPHIM. Illustrations of these guidelines, both in observance and violation, in actual programs are presented along with some practical suggestions to potential authors.

CW-05 **PROLOG AND ARTIFICIAL INTELLIGENCE TECHNIQUES FOR CHEMICAL EDUCATION.** D. Cabrol, Centre de Recherche Pedagogique et de Renovation Didactique en Chemie, Universite de Nice, Parc Valrose, 06034 Nice Cedex, France.

Prolog is a computer language that is capable of representing non-numerical information and inferring logical deductions from a set of facts and rules. In classical imperative languages (like BASIC or Pascal) most statements are used to give instructions to the machine and assign values to variables. Programming in Prolog consists primarily of describing the objects and their properties, asking the right questions, and expecting the Prolog interpreter to make the logical deductions rather than giving commands to the machine. Prolog is now available on microcomputers (MacIntosh and IBM PC) and new powerful implementations have been announced. This workshop will provide an introduction to the language with chemical examples using some Artificial Intelligence techniques.

Wednesday, July 30, 1986
Computer Hands-on IV
276 Strand Union Building

2:45—5:10PM

CH-24
TWO COMPUTER SIMULATIONS FOR LEARNING EQUILIBRIUM AND KINETICS
Smith AL

CH-25
SPREADSHEET TEMPLATES FOR VOCABULARY DEVELOPMENT
Aanerud T

CH-26
CHEM-TUTOR: AN ICAI SYSTEM FOR TEACHING CHEMISTRY
Fasching JL, Costa DJ, Suarez RB, Kowalski JG

CH-27
MICROCOMPUTERS IN THE CHEMISTRY TEACHER'S OFFICE
Clark RW

CH-28
COMPUTER ASSISTED SCIENCE LABS FOR CHEMISTRY
Beamish RF

CH-29
CHEMISTRY LABORATORY REPORTS USING A SPREADSHEET COMPUTER PROGRAM
Torop W

CH-24 TWO COMPUTER SIMULATIONS FOR LEARNING EQUILIBRIUM AND KINETICS. Allen L. Smith, Chemistry Department, Drexel University, Philadelphia, PA 19104

KSIMS, a simulation for determining the rate law and the reaction rate of a chemical reaction, allows you to perform numerical experiments with simple chemical reactions such as A + B + C = D + E. Students choose one of the 20 stored reactions, set initial conditions, run the reaction and collect concentration-vs-time data, and plot these data in various ways in order to determine the order of the reaction with respect to each reactant and the overall rate constant. **KSIMS** has been used in general chemistry to introduce the concept of rate laws, and with physical chemistry students to study pseudo-first order reactions and flooding. **EquilCalc**, a MultiPlan spreadsheet model which illustrates the concepts of equilibrium constant, reaction quotient, and extent of reaction, can be used to get the equilibrium concentrations for the reaction aA + bB = rR + sS, given the initial concentrations and the equilibrium constant. Any values can be used for a, b, r, and s. When you choose a value for the change in the concentration of A, **EquilCalc** calculates Q, compares it with K, and tells you how to vary this change to achieve equilibrium. Use of **EquilCalc** in general chemistry to compute equilibrium conditions for the Haber synthesis of ammonia will be described. Both simulations run on student-owned personal computers.

SPREADSHEET TEMPLATES FOR VOCABULARY DEVELOPMENT.
CH-25 Tom Aanerud, P.O. Box 1828, Riverton, WY 82501.

The AppleWorks(TM) software package of integrated spreadsheet, database, and word-processing programs provides the chemistry teacher with a powerful and easy-to-use productivity tool. One of the spreadsheet's most useful and generally underappreciated features allows for specialized "text entry" and subsequent manipulations that are usually unavailable in many other spreadsheet programs. Examples will show how to use these features to easily construct and modify vocabulary spreadsheet files, thus enabling a teacher to quickly generate worksheets and quizzes to help students improve their reading abilities. Valuable classtime can thus be used for development of related concepts and problem-solving skills rather than letting it degenerate into a vocabulary lesson.

CH-26

CHEM-TUTOR: AN ICAI SYSTEM FOR TEACHING CHEMISTRY. James L. Fasching, Duane C. Costa, Richard B. Suarez, Dept of Chemistry, James G. Kowalski, Dept. of Philosophy, University of Rhode Island, Kingston, RI 02881

The group of artificial intelligence techniques called expert systems form the technological base of the ICAI program called CHEM-TUTOR. This system will allow us to teach complex problem-solving in a usable and coherent manner. Actual procedural knowledge and the accompanying teaching rules will be programmed and the student and his/her interactions with CHEM-TUTOR will constitute a learner-centered educational system that will have positive effects on the teaching of chemistry across the United States. The design, structure, and performance aspects of this dual-expert system will be presented as well as the cost/benefit aspects of implementing such a system.

CH-27 MICROCOMPUTERS IN THE CHEMISTRY TEACHER'S OFFICE. Roy W. Clark, Department of Chemistry and Physics, Middle Tennessee State University, Murfreesboro, TN 37132.

Chemistry teachers who use, or are urged to use, microcomputers in their laboratories may overlook the many uses of a micro in the office. This paper concerns the uses to which a chemistry professor may put a well-chosen personal computer in the office environment, rather than in the laboratory. Without any programming knowledge at all, a teacher may purchase easy-to-use software which (1) keeps grades and computes averages automatically, (2) helps ease the multitude of letter-writing tasks, (3) files student data and also library data, (4) accesses the main computer if desired, but is totally private otherwise, and (5) stores syllabi, course proposals, or any imaginable writing task subject to frequent alteration. Test writing on a computer is not limited to multiple choice and true-false type tests. Many possibilities exist for creating modified forms of any type of test, or for merging several tests. In this paper I explain and demonstrate how my Kaypro computer has taken over my mundane office tasks and freed me for more creative writing.

CH-28 COMPUTER ASSISTED SCIENCE LABS FOR CHEMISTRY. Raymond F. Beamish, Chemistry Department, Wilson High School, Tacoma, Washington 98406.

"Computer Assisted Science Labs," developed by CASL, Inc., is a totally new dimension in the teaching of chemistry. For the first time it is possible for a single computer to be used effectively in a chemistry classroom by all students. The CASL laboratory system is a modern tool that will bring excitement to your chemistry program! CASL's system utilizes an electronic balance interfaced to an Apple Computer. This lab system gives immediate feedback within moments of lab completion, while still allowing students to do all their own lab work. This system grades each lab experiment and provides a printout showing all data and calculations. The lab system includes a reproducible student lab manual with teacher's key and training sequence, a set of 4 double sided disks containing 24 quantitative labs, and a CASL interface card. The system assumes that students and teachers have had little, if any, computer experience. This powerful laboratory system is a totally new approach to the teaching of chemistry. This system utilizes the computer user approach to give students valuable skills and knowledge of computers as they are being used in the modern laboratory.

CH-29 CHEMISTRY LABORATORY REPORTS USING A SPREADSHEET COMPUTER PROGRAM. William Torop, Department of Chemistry, West Chester University, West Chester, PA. 19383.

The electronic spreadsheet, the computerized version of a laboratory notebook, adapts easily to the needs of both students and instructors. The advantages are in the extended calculation power and speed of the microcomputer, and the ability to save calculations and use them later with an integrated word processor. The software is "user-friendly", requiring minimal knowledge about computers or programming. Spreadsheet templates for all the freshman laboratory experiments requiring calculations at West Chester University will be demonstrated. The use of these spreadsheets permits students to check their data immediately and to detect and correct experimental errors while still in the laboratory. The use of these spreadsheets by the instructors requires less time than the traditional hand calculator method of checking student reports.

Wednesday, July 30, 1986
POSTERS III
275 Strand Union Building

2:30-5:00PM

PO-28
ESTIMATION OF ERROR IN THE PHYSICAL CHEMISTRY LABORATORY USING LOTUS 1-2-3
Donato H Jr, Metz C

PO-29
MICROCOMPUTER APPLICATIONS IN CHEMISTRY: A ONE SEMESTER COURSE FOR MAJORS
Ward CR

PO-30
USING SERAPHIM/CHEMCOM INTERFACE SOFTWARE IN THE CLASSROOM
Pryde LT

PO-31
BROWNIAN MOTION IN THE CLASSROOM
Kirksey HG

PO-32
CHEMISTRY MAGIC SHOW FOR ENTERTAINMENT AND EDUCATION
DeLap JH, Reinhold T, Rodenbaugh L, Hede K

PO-33
THE TEACHING OF SCIENTIFIC CONCEPTS IN CHEMISTRY: MATTER
Tolentino M, da Silva RR, **Rocha-Filho RC**, Tunes E

PO-34
RECYCLING AND DISPOSAL OF CHEMICALS FROM THE UNDERGRADUATE LABORATORY
Armour M, Browne LM, Renecker DM

PO-35
FORENSIC SEROLOGY AS A UNIT IN THE BIOCHEMISTRY LAB: A VIDEO PAPER
Nienhouse EJ, Briner RC

PO-36
ELECTROCHEMISTRY OF BLOODSTAINS AS A LAB EXPERIENCE IN UNDERGRADUATE BIOCHEMISTRY
Briner RC, Nienhouse EJ, Olesen B

PO-37
ION SELECTIVE ELECTRODE FOR ORGANIC ANALYSIS. DETERMINATION OF VANILLIN
Lee AWM, Chan WH, Foo CL, Tang WK

PO-38
THERMODYNAMICS OF THE STIRLING ENGINE
Moores BW

PO-39
LASERS IN UNDERGRADUATE CHEMISTRY LABORATORIES
Szmuszkovicz JR

PO-40
PHYSICAL CHEMISTRY LABORATORY PROGRAMS
Anderson RH

PO-14 will also be displayed in this session- See Posters I, Monday afternoon for Abstract.

PO-28 ESTIMATION OF ERROR IN THE PHYSICAL CHEMISTRY LABORATORY USING LOTUS 1-2-3. H. Donato, Jr. and C. Metz, College of Charleston, Charleston, South Carolina 29424.

The physical chemistry laboratory at the College of Charleston is based on experiments contained in Experiments in Physical Chemistry by Shoemaker, Garland, Steinfeld, and Nibler. Students write a lab report summarizing their data, and calculations. Also they estimate the experimental error in their calculated results using the differential method of propagation of errors, which can lead to complex algebraic expressions, requiring considerable effort to derive and use.

We have developed a method of error propagation which is easy to understand, simple to execute, makes use of the widely used spreadsheet, Lotus 1-2-3, and which is equivalent to the differential method of error propagation. The method involves (1) estimation of random error in the independent variables; (2) calculation of the dependent variable using all possible combinations of the upper and lower error limits of the independent variables; and (3) obtaining an average value of the error in the dependent variable. Changing the error limits in an independent variable leads to immediate calculation of error in the dependent variable so that students can assess the effect of the size of the experimental error on the significance of their results. This method will be demonstrated using several physical chemistry laboratory experiments performed at the College of Charleston.

PO-29

MICROCOMPUTER APPLICATIONS IN CHEMISTRY: A ONE SEMESTER COURSE FOR MAJORS. C. R. Ward, Department of Chemistry, University of North Carolina at Wilmington, Wilmington, North Carolina 28403.

The ACS Committee on Professional Training has emphasized the importance of computer training in the undergraduate chemistry curriculum. When computer education is accomplished by introducing bits and pieces in different chemistry courses, the outcome is usually students who don't know enough to utilize the information in their own lab work. On most campuses, the Computer Science Department is of little help. Their courses typically lack the practical aspects of computer use and often contain little or no mention of microcomputers. I will describe a one-semester, team-taught, computer course developed by the Department of Chemistry at UNC-W that is required of all chemistry majors.

PO-30 USING SERAPHIM/CHEMCOM INTERFACE SOFTWARE IN THE CLASSROOM
Lucy T. Pryde, Department of Chemistry, Southwestern College
900 Otay Lakes Road, Chula Vista, CA 92010

Chemistry in the Community (ChemCom) is an innovative high school chemistry curriculum that is currently under field testing and development by the American Chemical Society. SERAPHIM, a computers in chemical education project centered at Eastern Michigan University, has available several pieces of software as part of an interface project with ChemCom. Many of these disks provide programs uniquely suited to the goals and objectives of ChemCom, including the emphasis on placing chemistry in a societal context, on decision-making skills, on data analysis, and on scientific inquiry. This paper will show the correlation between the SERAPHIM and ChemCom projects and make suggestions for future developments. In addition, much of the interface software can also be used to enrich existing chemistry courses at both high school and college levels. These possibilities will also be outlined in this paper.

PO-31 BROWNIAN MOTION IN THE CLASSROOM. H. G. Kirksey, Department of Chemistry, Memphis State University, Memphis, TN 38152.

Students may view simultaneously chemical and physical phenomena by use of a videocassette recorder (VCR) and monitor(s) in a large classroom. Brownian motion may be shown to students in this fashion. Techniques for displaying brownian motion and measuring the diffusion coefficient for brownian particles will be demonstrated in this presentation.

PO-32 CHEMISTRY MAGIC SHOW FOR ENTERTAINMENT AND EDUCATION, James H. DeLap, Tracy Reinhold, Lori Rodenbaugh, Karyn Hede, Box 8277, Stetson University, DeLand, FL 32720

Since chemistry is an experimental science, it is best taught with demonstrations which are both educational and entertaining. For the past four years, students at Stetson University have presented a "Chemistry Magic Show" for students in the elementary and secondary schools of Volusia County. The show has been received with enthusiasm by both students and teachers. Slides and a videotape of some of the demonstrations will be shown.

PO-33 THE TEACHING OF SCIENTIFIC CONCEPTS IN CHEMISTRY: MATTER. M. Tolentino, R.R. da Silva, R.C. Rocha-Filho and E. Tunes, UFSCar, C.P.676, 13560 S.Carlos SP, Brazil.

The usual schemes for the classification of matter present two general types of matter: pure substances (elements and compounds) and mixtures (homogeneous and heterogeneous). Any classification scheme of concepts must show a hierarchy from the more general concepts to the more specific ones; furthermore, any less general concepts linked to a more general one must necessarily be excludent ones. Thus, the usual schemes for the classification of matter do not follow these premises, since the concepts of mixtures and substances are not mutually excludent; this happens because types of matter and its occurrence forms are combined in a same scheme. Hence, it is proposed that separate schemes be used, one according to types and one according to forms of occurrence. The former could be: MATTER: elementary substances and compounds; the latter: MATTER: pure substances and mixtures. Finally, since scientific concepts are those that are part of hierarchical systems of inter-relationships so as to permit acts of generalization, every concept in the above mentioned schemes must be defined in a way such as to take this into consideration.

(CAPES/PADCT)

PO-34 RECYCLING AND DISPOSAL OF CHEMICALS FROM THE UNDERGRADUATE LABORATORY. Margaret-Ann Armour, Lois M. Browne, Donna M. Renecker, Department of Chemistry, University of Alberta, Edmonton, Alberta, Canada T6G 2G2.

Practical methods for the safe disposal or recycling of chemicals from both undergraduate and research laboratories have been developed as part of a grant-funded research program. The methods have been tested in the laboratory for completeness of reaction, nature of products and safety to the operator. Precise conditions for the reactions have been determined and several of them have been tested in an independent laboratory. The cost-effectiveness of this on-site disposal will be discussed, as will the effect the program has on encouraging awareness in laboratory workers of the need for responsible handling and disposal of waste and surplus chemicals.

PO-35 FORENSIC SEROLOGY AS A UNIT IN THE BIOCHEMISTRY LABORATORY: A VIDEO PAPER. E. J. Nienhouse, Department of Chemistry, Ferris State College, Big Rapids, MI 49307; R.C. Briner, Director, SEMO Regional Crime Laboratory, Cape Girardeau, MO 63701

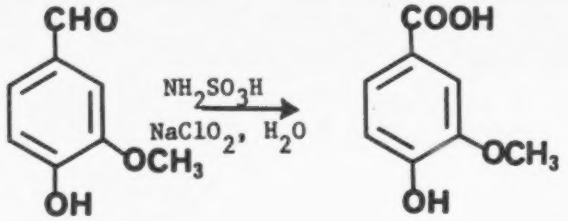
It is the contention of the authors that the traditional biochemistry laboratory course substantially benefits from a brief unit on forensic serology, particularly as this relates to the analysis of blood enzymes, proteins and glycoproteins. Such a unit provides students with an exceptional opportunity of studying and applying the techniques routinely used in a crime lab setting to the biochemistry laboratory. The excitment generated from working on "real life" cases involving dried blood stains promotes a greater level of understanding of such a unit as the use of electrophoresis to separate and identify blood enzymes and proteins as genetic markers. The unit also provides an opportunity to review and expand immunological concepts and techniques as well. Since many undergraduate biochemistry students are in allied health fields, the unit on forensic serology becomes an important part of their educational experience. In addition to the comments from the presentor, a short videotape will provide the audience with ideas for including this new and challenging unit into the biochemistry laboratory experience.

PO-36 ELECTROPHORESIS OF BLOOD STAINS AS A LABORATORY EXPERIENCE IN UNDERGRADUATES BIOCHEMISTRY. R. C. Briner, SEMO Regional Crime Lab, SEMO University, Cape Girardeau, MO 63701. E. J. Neinhouse, Dept. of Chemistry, Ferris State College, Big Rapids, MI 49307. Bjorn Olesen, Dept. of Chemistry, SEMO State University, Cape Girardeau, MO 63701.

The use of the biochemical technique of electrophoresis in undergraduate biochemistry is quite standard. Separation of serum proteins on various media is perhaps a standard laboratory experiment; however this is often quite routine and uninteresting to students. We have found the use of electrophoresis to identify "genetic markers" in blood stains makes the whole experiment more interesting. The use of blood stains produced by "finger-stick" of the students has also allowed introduction into human genetics and concepts of inclusion and exclusion as to biological testing as related to forensic science (serology). The equipment and chemicals necessary are quite inexpensive and well within the budgets of any small department. The laboratory time involved is within the time frame of most biochemistry laboratories as most electrophoresis runs are 1 hour or less, with 15-30 minutes incubation time for visualization of banding patterns. Several examples of this approach will be discussed. We feel this is a valuable addition to the biochemistry laboratory experience and also is related to the "real World" (i.e. paternity testing and forensic serology).

PO-37 ION SELECTIVE ELECTRODE FOR ORGANIC ANALYSIS. DETERMINATION OF VANILLIN. Albert W.M. Lee, W.H. Chan, C.L. Foo and W.K. Tang, Department of Chemistry, Hong Kong Baptist College, 224 Waterloo Road, Hong Kong.

Ion Selective Electrodes (ISE), first originated from inorganic analysis, have been successfully applied to organic analysis during the past decade. Since direct ISE method for aldehydes determination is still lacking, a PVC membrane electrode was developed for the indirect sensing of vanillin after in situ oxidation to vanillic acid by chlorite and sulfamic acid. The assembly, working pH range, sensitivity and selectivity of the electrode were investigated. The application of the electrode to the determination of vanillin in some ice cream samples will also be discussed.



PO-38 THERMODYNAMICS OF THE STIRLING ENGINE. Brian W. Moores, Department of Chemistry, Randolph-Macon College, Ashland, VA 23005

Several heat engines are under investigation which offer significant advantages over the conventional spark-ignition (Otto) engine in the automotive and other industries. One of these, the Stirling engine, appears to be superior to the others in some respects. The availability of inexpensive working models of this engine, and the simplicity of the thermodynamic analysis of the Stirling cycle, make it an attractive topic to include in the physical chemistry course, particularly with engineering students. A model of the Stirling engine will be demonstrated, the thermodynamics of the Stirling cycle will be discussed, and the relative merits of the Stirling and other heat engines will be compared.

PO-39 LASERS IN UNDERGRADUATE CHEMISTRY LABORATORIES. Jacqueline R. Szmuszkovicz, 3420 Pinegrove Lane, Kalamazoo, Michigan, 49008.

References on the basic theory of laser light and its applications have been compiled and synthesized. Included is a bibliography of suggestions for undergraduate experiments using lasers.

PO-40 PHYSICAL CHEMISTRY LABORATORY PROGRAMS, Robert Hunt Anderson, Chemistry Department, Western Michigan University, Kalamazoo, MI 49008.

Programs for data analysis on our DEC-10 mainframe for the following 12 physical chemistry laboratory experiments will be presented: nitrogen dioxide equilibrium, sulfuric acid--alcohol equilibrium constant, conductivity of HCl and succinic acid solutions, flow calorimeter for gaseous heat capacities, heat of solution, ionic activity coefficients for calcium iodate or silver acetate, IR gas spectra of HCl and DCl or HBr and DBr, second order kinetics of aniline and iodine, activation energy for hydrolysis of sucrose, M.W. of a polystyrene by viscosity, X-ray powder diffraction, mole fraction versus refractive index plot.

These BASIC and FORTRAN programs have been written and used during a ten year period. In addition several general programs and subroutines are available. The least squares and plotting programs are most used except for the data entry and manipulation subroutine which is used in most of the fortran programs. It permits data entry and manipulation as well as storage and getting stored data. These programs will be briefly described as well as various problems which arise from their use. My solutions or at least responses to these problems will be discussed.

Wednesday, July 30, 1986
Innovative Programs III
Strand Union Ballroom - B

2:45PM
Introduction
Session Chair, **Christoph MS**

2:50
IP-18
KSAM: ENCOURAGING TEACHERS TO TURN KIDS ON TO SCIENCE
Coleman SL

3:05
IP-19
CHEMISTRY FOR ELEMENTARY TEACHERS
Smith PJ

3:20
IP-20
A LABORATORY EXPERIENCE FOR CHILDREN
Milton PA

3:35
IP-21
TEACHING TEACHERS CHEMISTRY: THE FORDHAM EXPERIENCE
Howe-Grant ME

3:50
IP-22
AAAS AND PRE-COLLEGE SCIENCE EDUCATION
Bunce DM

4:05
IP-23
CHEMISTRY FOR GIFTED CHILDREN GRADES 2-6
Borer LL

4:20
IP-24
CHEMISTRY IS FUN/LEARNING THROUGH DEMONSTRATIONS
Marcello JA

4:35
IP-25
ENVIRONMENTAL CHEMISTRY: A SIX-HOUR MINICOURSE FOR GRADES
6, 7, & 8
Wilcox VA

4:50
IP-26
SCIENCE PRESENTATIONS FOR PRE-HIGH SCHOOL STUDENTS
Sarquis JL

5:05
Discussion

IP-18 KSAM: ENCOURAGING TEACHERS TO TURN KIDS ON TO SCIENCE Sharon L. Coleman, Department of Chemistry, Southeast Mo. State University, Cape Girardeau, MO 63701.

Southeast Missouri State University and public schools in the area have joined hands in a three-year project supported by the National Science Foundation, the State Board of Education, and Southeast Missouri State University. KSAM stands for "K-6 Science and Mathematics Improvement, Southeast Missouri" and is the product of 1½ years planning by university faculty, public school administrators, elementary and secondary teachers and the Department of Elementary and Secondary Education personnel.

The purpose of this project is to promote and maintain the natural curiosity and enthusiasm of children for science by changing teachers' attitudes towards hands-on experiences in the classroom.

The KSAM project is divided into four one-credit hour short courses, one each in the subject areas of (1) biological science, (2) earth science, (3) mathematics and (4) physical science. This talk will focus on the organizational and sustaining design of the project as well as the chemical content presented in the physical science portion of the course.

IP-19 CHEMISTRY FOR ELEMENTARY TEACHERS. Patricia J. Smith, Science Department, Air Academy High School, USAF Academy, CO 80840.

This paper will discuss a chemistry course developed specifically for elementary teachers as a part of a district science inservice program. Both concepts and processes of chemistry are stressed. Each area studied includes adaptation of the material for use at the K-5 level. The materials developed for the course by the instructor and the elementary teachers will be available.

IP-20 A LABORATORY EXPERIENCE FOR CHILDREN. Pamela A. Milton, Department of Chemistry, Thiel College, Greenville, PA 16125.

A series of Saturday morning laboratory and in-class school experiences for third through fifth grade children will be described in detail. These labs include the following: a) acid-base determination using red cabbage indicator and simple pH-meters on common drinks and household chemicals; b) electrical conductivity tests using light-emitting diodes; c) crystallization, filtration, and the use of a microscope; d) the interaction of dry ice with water and acid-base indicators; e) chemical changes.

IP-21 TEACHING TEACHERS CHEMISTRY: THE FORDHAM EXPERIENCE. M.E. Howe-Grant, Department of Chemistry, Fordham University, Bronx, New York 10458.

Two chemistry courses have been developed as a part of Fordham University's Math/Science Fellowship in Elementary Education Program. These courses have been especially designed to meet the needs/interests of elementary school teachers with an eye toward science in the New York State Cirriculum. One course, entitled "Chemistry In and Out of the Kitchen," is designed for teachers of Kindergarten through Grade 3 and focuses on the physical and chemical changes associated with household experiences. The other course, "Chemistry In the World Around Us," is for teachers of Grades 4-6; this course centers around such changes as corrosion and stone decay. Each course, although developed and presented within the chemistry department, carries 2-credits in the Graduate School of Education.

The trials, tribulations, and joys of developing and presenting these courses will be discussed, as will some of the successes and failures of the Math/Science Program. Course content will also be presented.

IP-22 AAAS AND PRE-COLLEGE SCIENCE EDUCATION. Diane M. Bunce, Office of Science and Technology Education, AAAS, 1333 H St., NW, Washington, D. C. 20005

The American Association for the Advancement of Science has several projects and activities whose goals are to improve pre-college science and mathematics education. During this session, several of these projects will be reviewed, including: (1) Science Resources for Schools - a series of activity orientated science packets for middle and junior high school, (2) Challenge of the Unknown - a series of films presenting the use of mathematics and problem solving in real life situations (junior high school). (3) Science Seminars for Teachers - a seminar series for junior and senior high school teachers based upon relevant symposia presented at the annual AAAS meeting. (4) National Forum for School Science - an annual study resulting in a colloquium and published report discussing and analyzing one aspect of science and mathematics education. (5) Project 2061 - a three phase project to decide, recommend, and implement the teaching of science and mathematics which is essential for all pre-college students.

IP-23

CHEMISTRY FOR GIFTED CHILDREN IN GRADES 2-6.
Londa L. Borer, California State University-Sacramento, Sacramento, CA 95819.

Del Paso Manor Elementary School in Sacramento has a gifted classroom for each of the grades 2 through 6. The author has designed and presented a fourteen week chemistry program for all five grades. It was a challenge to gear the material to all age levels, however the classroom teachers were very helpful in working out the details and we had a very successful semester. All fourteen lessons were "hands-on" experiences emphasizing the scientific method of thinking.

Approaches used for the experiments as well as a bibliography for elementary school experiments and equipment will be presented.

IP-24 CHEMISTRY IS FUN/ LEARNING THROUGH DEMONSTRATIONS. Joseph A. Marcello, University of Idaho, Moscow, Idaho, 83843

This presentation will describe an intensive one-week workshop for elementary school teachers. The workshop is designed to acquaint teachers with the chemical principles needed to carry out chemical demonstrations in the classroom. These demonstrations can then be used to introduce young students to the world of chemistry. The teachers have the opportunity in this workshop to develop their demonstration skills and to learn some chemistry through hands-on experience in the laboratory. Many of the demonstrations used in this workshop can be carried out with simple everyday chemical substances that are available from the local supermarket.

IP-25 ENVIRONMENTAL CHEMISTRY: A SIX-HOUR MINICOURSE FOR GRADES 6, 7, & 8, Valerie A. Wilcox, Museum of Science, Science Park, Boston, Massachusetts, 02114

This six-hour minicourse on Environmental Chemistry was given in March, 1986, as part of the Museum of Science's Topics in Science series, designed for students in grades 6, 7, and 8. Twenty students studied methods of pH determination, took samples of Charles River water, did a dissolved oxygen titration, and incubated coliform culture in three two-hour classes.

Sample student handouts and worksheets will be available.

IP-26 SCIENCE PRESENTATIONS FOR PRE-HIGH SCHOOL STUDENTS. J. L. Sarquis, Chemistry Dept., Miami University, Oxford, OH 45056.

Today there is much concern about science education at the pre-secondary level. One forum for introducing students to science and nurturing their interest in science is a chemistry demonstration presentation. Presentations, under the title, "The Wonders of Chemistry," have been given for school children ranging from Kindergarten to Junior High School. The goal of the presentation is to encourage an interest in science that will continue after the show and to explain the phenomena presented at a level appropriate for the specific student audience. Students attending are given a handout which includes the procedure for a simple do-it-at-home experiment and references to additional science books for children. These presentations are enthusiastically received by the students and their teachers and are rewarding to the presentor as well. The types of demonstrations used will be listed and the techniques for adapting them to different grade level audiences will be discussed. Also procedures for involving student volunteers from the audience will be described. Finally, the logistics of putting on such a presentation will be detailed.

Wednesday, July 30, 1986
Demonstrations by **Demonstration** III
101 Gaines Hall

2:30PM
Introduction
Session Chair, **Seydel J**

2:35
DE-21
YOU LEAD THEM TO LAB, CAN YOU MAKE THEM THINK?
Schrader CL

Moved to Dreyfus presents, Monday afternoon

3:05
DE-22
WHY NOT MAKE MORE COMPLETE USE OF YOUR HIGH SCHOOL LAB?
Kilner C

3:35
DE-23
CHEMISTRY IS JUST A BONUS
Omundson JW

4:05
DE-24
POLYMERS — THE ADDITION OF POLYMERS TO YOUR COURSE BY THE CONDENSATION OF EXISTING MATERIAL
Bleam Jr WR

4:35
DE-25
HISTORY OF CHEMISTRY TOUR OF EUROPE
Marek LR, Gerlach D

5:05
Discussion

DE-15 YOU LEAD THEM TO LAB, CAN YOU MAKE THEM THINK, Clifford L. Schrader, Dover High School, Dover, Ohio 44622.

A series of experiments that are designed to require students to analyze, synthesize and evaluate data will be discussed and demonstrated. These experiments use a minimum of equipment, and safe, inexpensive chemicals. The same chemical systems are recycled but new information requires the development of new concepts, which is then introduced and explored. Techniques, ideas and concepts from several different experiments may be used to synthesize a new concept. An important activity is to encourage the students to seek connections between experiments. Finally each experiment is designed to suggest several additional ideas that can be explored by an independent project. The role of research projects in introductory chemistry will be discussed.

DE-16 WHY NOT MAKE MORE COMPLETE USE OF YOUR HIGH SCHOOL LAB? Gary Milner, Exeter High School, Exeter, N.H. 03833.

The overall chemistry curriculum as well as your specific syllabus presents a myriad of possibilities for involving students in hands-on chemistry. Numerous studies (in addition to *your* own experiences) have shown that students learn *more* when they *do* more. My students are becoming more self-reliant as I discover more ways for them to participate in observation and discovery. In this short presentation I will give examples of ways in which I have been able to maximize the use of my laboratory within the usual constraints of scheduling, class size, etc. Then I would like to have others share their own bright ideas. These are the categories I use: Lab Project -- 1-2 weeks full time (5-7 periods/week), Extended Lab -- 2-3 days (3-5 periods), normal lab -- 2 periods, Lab Activity -- 1 period, and checksheet activity/mini-activity -- 5 minutes to ½ period. Each format has its own distinct way in which the student assumes and demonstrates responsibility for its content.

DE-17

CHEMISTRY IS JUST A BONUS, Jerrold W. Omundson, Memphis University School, 6191 Park Avenue, Memphis, TN 38119

This paper raises several questions concerning just what we should be teaching toward at the high school level. It is my contention that we identify our primary role as teachers of adolescents and very young adults--teaching how to think; to reason inductively and deductively; to apply the mathematics learned in arithmetic classes; to organize data and evaluate this data to a reasonable solution; to give a student confidence in their ability to think and to reason; to instill a reasonable amount of self-discipline in our students. I use chemistry as a vehicle to accomplish this end.

DE-18

POLYMERS -- THE **ADDITION** OF POLYMERS TO YOUR COURSE BY THE **CONDENSATION** OF EXISTING MATERIAL W. R. Bleam, Jr. Radnor High School, 130 King of Prussia Rd., Radnor, PA 19087

More than 60 % of the chemists presently working in the field are engaged in work related to polymers, and yet most high school chemistry courses teach nothing about polymers. Even many colleges do not offer polymer chemistry courses as part of their program. This presentation is an attempt to begin to change that situation.

The presenter will review his 1984 experiences in the National Science Teachers Association Honors Teachers Workshop in Polymer Chemistry at ARCO Chemical Company. He will show how he infuses polymers into the existing curriculum rather than deleting topics to fit in polymers, and he will demonstrate several examples of polymer synthesis and discuss properties of polymers. The relevance of polymers to students' everyday lives will be discussed, as well as how to show students this relevance. Useful handouts include student text, activities, teacher visual aids and resource materials.

IE-19 HISTORY OF CHEMISTRY TOUR OF EUROPE. Lee R. Marek, Naperville North High School, Mill and Ogden Avenue, Naperville, Illinois 60566 and Diane Gerlach, Tremper High School, 8560-26th Avenue, Kenosha, Wisconsin 53140

Join us on a slide tour of fourteen countries and visit historical sites of special interest to chemists. In our travels we will "meet" some of the people and see some of the places you have read about in the optional or extension sections of your textbooks. The exhibits provide tantalizing glimpses into the lives and personalities of the people who worked there. A special attempt was made to photograph "human interest" details which do not always make their way into the textbooks. See the platinum crucibles of Berzelius (still time to order yours on next year's budget). Have dinner with Hund and discuss his rule. Learn that Mendeleev developed the periodic table in one night! Was Kekule' Czech, French, or German? Did he or did he not dream up benzene? (see "C & E News" October 85 through February 86 for the answer, we don't want to touch this argument!) View Bunsen's death mask, Volta's skull and his piles, Newton's apple tree, Joule's snowball machine, Marie Curie's still radioactive lab smock, Van't Hoff's tetrahedral carbon models and the Nobel Prize Cemetery. Find out if Tycho Brahe had a gold nose and died of a burst bladder while dining with a king. See which museums have good collections of materials relating to chemistry. People, places and things will be presented that could make the history of Chemistry come alive, or at least make your trip to Europe more than just visiting the Eiffel Tower.

Wednesday, July 30, 1986
Buffalo Barbecue and Bonfire

5:00PM -- XXXXXXXX(AM)
Coleman WF, Master of Ceremonies

SUMMARY OF CONFERENCE WORKSHOPS

Preconference Workshops

272-276 Strand Union Building
Sunday, July 27, 1986
WK-01
8:00AM-5:00PM
SERAPHIM GAMEPORTS I
$25.00

272-276 Strand Union Building
Sunday, July 27, 1986
WK-02
8:00AM-5:00PM
SERAPHIM GAMEPORTS II
$35.00

272-276 Strand Union Building
Sunday, July 27, 1986
WK-03
8:00AM-5:00PM
SERAPHIM APPLEWORKS
$20.00

272-276 Strand Union Building
Sunday, July 27, 1986
WK-04
8:00AM-5:00PM
SERAPHIM INTRODUCTION TO MICROCOMPUTERS
$10.00

131 Gaines Hall
Sunday, July 27, 1986
WK-05
1:00-4:00PM
CROSSWORD PUZZLE CONSTRUCTION
Orna MV
No Fee

207 Gaines Hall
Sunday, July 27, 1986
WK-06
1:00-5:00PM
MICROSCALE ORGANIC LABORATORY TECHNIQUES
Mayo DW, Pike RM, Butcher SS
$30.00

WK-01 FUNDAMENTALS OF GAME-PORT INTERFACING, Seraphim Staff.

This workshop will show you how to build a thermistor probe and adapter box that will permit recording of temperature data by Apple II, Commodore-64, or IBM PC computers. Necessary parts for building the probe an adapter box will be supplied, as will software for collecting and analyzing data. No previous electronics experience is necessary; a little computer literacy will help. Those interested in this workshop should indicate whay type of computer is available to them in their schools.

WK-02 ADVANCED GAME-PORT INTERFACING, Seraphim Staff.

For those with some experience in building electronics projects, or those who have participated in the workshop "Fundamentals of Game-Port Interfacing." It will involve construction of an adapter box, thermistor probe, and Blocktronic I colorimeter, some theory of game-port and other interfacing, and experience with data-collection software. Please indicate whether Apple II, Commodore-64, or IBM PC computers are available in your school.

WK-03 APPLEWORKS FOR CHEMISTRY TEACHERS, Seraphim Staff.

Practical applications of spreadsheet and database programs for chemistry classroom and laboratory and give you hands-on experience with Appleworks. No previous experience with this program is expected; a little computer literacy will help. Most schools have Appleworks available for business-oriented faculty and students; if yours does, here's your opportunity to find out how to use it to your advantage.

WK-04 INTRODUCTION TO MICROCOMPUTERS, Seraphim Staff.

This workshop will give the person who wants to begin using microcomputers in the chemistry classroom an introduction and overview of how computers work, how they can be used to enhance teaching, as well as an opportunity to examine both commercial and SERAPHIM software.

WK-05 CROSSWORD PUZZLE CONSTRUCTION FOR FUN AND INSTRUCTION.

This workshop will give the rudiments of puzzle construction including development of a theme, incorporation into a grid, selection of grid size and type, and clue construction. Participants should bring a dictionary, preferably Webster's Collegiate, but even a small paperback will do if packing is tight. Grid paper, pencils and plenty of erasers will be supplied.

AV needs: Overhead projector; magic markers; about 10 blank overhead transparencies.

WK-06 MICROSCALE ORGANIC LABORATORY TECHNIQUES. Mayo DW., Chemistry, Bowdoin College Brunswick, Maine.

The Microscale Organic Laboratory represents a fresh approach to the training of students at the introductory stage of their organic laboratory experience. Working at the milligram level the student quickly discovers: (1) a clean laboratory atmosphere; (2) the ease with which most manipulative microtechniques can be acquired; and (3) the power of having a heavily integrated use of chemical instrumentation during the purification and characterization of products from organic reactions.

The instructor, on the other hand, observes:

(1) a significant reduction in fire and explosion hazards;
(2) a marked decrease in chemical purchase and storage costs;
(3) a vanishingly small amount of chemical waste products; and
(4) an increased diversity and sophistication of experiments to select as laboratory exercises.

Finally, and perhaps most important, in a well run laboratory of this nature it would appear possible to maximize student interest and confidence in a minimum amout of time. Microscale programs hold the promise of yielding better education undergraduates with a stronger orientation toward chemistry.

Workshops During Conference

228 Gaines Hall
Monday, July 28, 1986
WK-17
9:30-12:30AM
WORKSHOP IN JEWELRY DESIGN
Coleman RR, Sturtevant FF
$10.00
(second offering)

228 Gaines Hall
Monday, July 28, 1986
WK-13
2:30-5:30PM
ELECTROFORMING-ELECTROPLATING WORKSHOP FOR CHEMISTRY
Sturtevant FF, Coleman RR
$15.00
(second offering)

203 Gaines Hall
Monday, July 28, 1986
WK-07
2:30-5:00PM
HANDS-ON EXPERIENCES WITH PRE-HIGH SCHOOL CHEMISTRY LABS
Barhydt F
$10.00

207 Gaines Hall
Monday, July 28, 1986
WK-06
2:30-6:30PM
MICROSCALE ORGANIC LABORATORY TECHNIQUES
Mayo DW, Pike RM, Butcher SS
$30.00
(third offering)

Strand Union Ballroom - C
Tuesday, July 29, 1986
WK-08
2:30-3:30
ZEN AND THE ART OF LABORATORY MAINTENANCE
Ealy Jr JL, Bowen-Ealy J
No Fee

33 Gaines Hall
Tuesday, July 29, 1986
WK-09
2:30-3:30
HOW WE KNOW WHAT WE KNOW: NSTA-SHELL INDUSTRY WORKSHOP ON ANALYTICAL CHEMISTRY
Waterman EL
No Fee

125 AJM Johnson Hall
Tuesday, July 29, 1986
WK-10
2:30-4:30PM
WORKSHOP: DEVELOPMENT OF AN EXPERIMENT FROM OBSERVATIONS
Neidig HA, Teates TG
No Fee

234 Gaines Hall
Tuesday, July 29, 1986
WK-11
2:30-4:30
ADVANCED PLACEMENT WORKSHOP
Jekel EC, Quiring FS
No Fee

306 Gaines Hall
Tuesday, July 29, 1986
WK-12
2:30-5:30
DEMONSTRATIONS IN CHEMISTRY-THE JOYS OF SOUND & LIGHT IN THE LAB.
Talesnick I
$30.00

228 Gaines Hall
Tuesday, July 29, 1986
WK-13
2:30-5:30
ELECTROFORMING-ELECTROPLATING WORKSHOP FOR CHEMISTRY TEACHERS
Sturtevant FF, Coleman RR
$15.00

Strand Union Ballroom - B
Tuesday, July 29, 1986
WK-14
2:30-5:30
CHEMCOM--UPDATE FROM THE FIELD TEST
Ware SA, Lippincott WT, Heikkinen H
No Fee

132-135 Gaines Hall
Tuesday, July 29, 1986
WK-15
2:30-5:30
ELEMENT OF THE WEEK--A DESCRIPTIVE CHEMISTRY TECHNIQUE
Borsch E, Berger S, Hill A, Holmquist R
$5.00

Strand Union Ballroom - D
Wednesday, July 30, 1986
WK-16
9:00-12:00AM
WRITING IN SCIENCE COURSES
Neidig HA, Bean J
$5.00
(two simultaneous sections)

228 Gaines Hall
Wednesday, July 30, 1986
WK-17
9:00-12:00AM
WORKSHOP IN JEWELRY DESIGN
Coleman RR, Sturtevant FF
$10.00

304 Reid Hall
Wednesday, July 30, 1986
WK-18
2:30-5:00
CHEMICAL DATA PROCESSING WITH MINITAB
Pollnow G
$5.00

Post-Conference Workshops

207 Gaines Hall
Thursday, July 31, 1986
WK-06
8:30-12:30PM
MICROSCALE ORGANIC LABORATORY TECHNIQUES
Mayo DW, Pike RM, Butcher SS
$30.00
(second offering)

306 Gaines Hall
Thursday, July 31, 1986
WK-12
9:00-12:00noon
DEMONSTRATIONS IN CHEMISTRY-THE JOYS OF SOUND & LIGHT IN THE LAB.
Talesnick I
$30.00
(second offering)

Strand Union Ballroom - A
Thursday, July 31, 1986
WK-19
8:00-3:00PM
WORKSHOP ON CAS ON-LINE
Kozlowski A, Wikholm RJ
$5.00

Strand Union Ballroom - D
Thursday, July 31, 1986
WK-20
8:30-5:00PM
NSF/ACS IN-SERVICE WORKSHOP
Brooks DW
No Fee

Strand Union Ballroom - B
Thursday, July 31, 1986
WK-21
8:00-5:00PM, to Friday, 8:00-12:00noon
JCPDS-ICDD WORKSHOP ON X-RAY ANALYSIS
Jenkins R, McCarthy G
$25.00

WK-07 HANDS-ON EXPERIENCES WITH PRE-HIGH SCHOOL CHEMISTRY LABS FOLLOWED BY A DISCUSSION OF STRATEGIES NEEDED TO IMPROVE THE QUANTITY OF THESE TYPES OF EXPERIENCES IN OUR ELEMENTARY AND JUNIOR HIGH SCHOOLS. Frances B. Barhydt, 1504 N. Broom Street, Bldg. 2, Unit 18 Wilmington, Delaware 19806

For those who are interested in gaining first-hand experience with pre-high school science curricula and problems which make it difficult to implement these curricula. The participants will engage in two brief chemistry labs that are taught at the pre-high school levels. The follow-up discussion will include level of appropriateness, most common teacher concerns, level of teacher training needed, problems caused by the "back-to-basics" movement and suggestions for "selling" chemistry education to pre-high school teachers and administrators. Limited to thirty participants.

WK-08 ZEN AND THE ART OF LABORATORY MAINTENANCE. James L. Ealy, Jr. and Julie Bowen-Ealy, The Hill School, Pottstown, PA 19464

Participants in this workshop will be shown how to maintain an high school chemistry lab in working condition, with emphasis on the honors and AP chemistry equipment. The ordering of chemicals in the least expensive form, substitutes for "harmful" reagents, safety and safe disposal of residues. Also included will be ways of resurrecting broken glassware (burets), new sources of old chemicals (9% hydrogen peroxide) and old laboratory equipment, and useful demonstration with a new twist. These ideas are the culmination of ten years of presenting two week workshops for teachers of Advanced Placement, Honors, and regular high school chemistry.

WK-09 HOW WE KNOW WHAT WE KNOW: The Role of Analytical Instrumentation in Modern Chemistry
Edward L. Waterman, Rocky Mountain High School, 1300 West Swallow Road
Fort Collins, Colorado 80526

Sophisticated analytical instruments are fundamental to the process and progress of modern chemistry. The chemical knowledge that is the cornerstone of our modern society is rooted in the probing of matter using instrumental techniques. Yet in our high school classrooms we teach little about these state-of-the-art instruments which are on the cutting edge of modern research. As a result, students often are perplexed about "how we know what we know".

Perhaps nowhere in the world is there assembled a wider array of state-of-the-art analytical instrumentation than at the Bellaire and Westhollow Research Centers of the Shell Development Corporation in Houston, Texas. Having attended a two week NSTA Workshop on analytical chemistry at Shell, the author will present a survey of modern analytical instrumentation through color slides illustrating working instruments on the cutting edge of modern research. The basic operating principles and the type of chemical information each instrument provides will be discussed in terms of what is already taught in high school chemistry. Participants will carry out an example activity relevant to the principles and practice of modern instrumentation and appropriate for a typical high school chemistry class.

WK-10 "WORKSHOP: DEVELOPMENT OF AN EXPERIMENT FROM OBSERVATIONS," H. Anthony Neidig, Department of Chemistry, Lebanon Valley College, Annville, PA 17003, (717) 867-6146; Thomas G. Teates, College of Education, Virginia Tech University, Blacksburg, VA 24061.

The purpose of this workshop is to develop an experiment which can be used to introduce average secondary school chemistry students to the ideas of equilibrium, especially Le Chatelier's Principle. After the pre-laboratory discussion, the participants will observe and record the results of various interactions of a given set of reagents. During the post-laboratory discussion, various ways will be developed for using the observations as a basis for writing an experiment.

Consideration will be given to chemical systems involving such ions as cobalt(II) and iron(III).

The workshop is limited to 30 high school teachers.

WK-11 ADVANCED PLACEMENT WORKSHOP. Eugene C. Jekel, Hope College, Holland, MI 49423; Frank S. Quiring, Clayton High School, #1 Mark Twain Circle, Clayton, MO 63105.

Session at 2:30. A few experiments that have been a part of the instructional program in the Hope College NSF supported Summer project for high school chemistry teachers will be described. They represent the level of laboratory work currently done in freshman courses. Suggestions for making them workable in short laboratory periods of the typical high school schedule will be offered. Handouts will be available. Session at 3:30. Topics include: starting an AP Chemistry course, sequencing of AP Chemistry into the science curriculum, the selection of students, class size, choice of syllabus topics for the course, expected rigor of these topics, selection of texts and laboratory manuals, the laboratory program, costs, the AP Chemistry examination, grading of the AP exam, grading standards, the scores and the distribution, policies of colleges and universities in placement and credit; and the rewards for the student, teacher, and college. The two sessions will be presented by various representatives from the NSF-supported Summer Project at Hope College which for a number of years has assisted high school teachers who present or are planning Advanced Placement Chemistry courses.

WK-12 DEMONSTRATIONS IN CHEMISTRY - THE JOYS OF SOUND AND LIGHT IN THE LABORATORY - IRWIN TALESNICK - FACULTY OF EDUCATION, QUEEN'S UNIVERSITY, KINGSTON, ONTARIO, CANADA K7L 3N6

The workshop activities will include a number of student experiments and teacher demonstration for use in high school and junior college classrooms. The experiments all utilize simple and inexpensive equipment and materials. The subject matter covered will be in the areas of gas laws, electrochemistry, equilibrium, atomic structure and redox. Participants will perform many of the experiments and discuss their role in the classroom.

Participants will use the kit of materials to make a number of simple pieces of equipment during the workshop and again in their own schools. Each of the experiments is designed to produce a sense of entertainment as well as to introduce and/or reinforce a particular concept in chemistry.

WK-13 ELECTROFORMING-ELECTROPLATING WORKSHOP FOR CHEMISTRY TEACHERS. Floyd F. Sturtevant, Ames High School, Ames, Iowa 50010. Robert R. Coleman, Angels Camp, CA 95222.

Using a five liter plating tank similar to that used by the professional electroplater and a bright acid copper bath, the participant will electroplate copper on leaves or similar objects. Graphite sketches made on plastic will be used to illustrate the principles of electroforming.

Quantitative data will be taken to determine the relationship between the current and the quantity of products produced at the electrodes. An interesting extension is to compute number of copper ions deposited per second at cathode. Colorimetric and volumetric analysis of the important components of the plating solution will be made.

The electroforming-electroplating activity illustrates how chemistry can create useful products while teaching chemical principles. This activity may encourage art and chemistry departments to form interdisciplinary activities.

Technical details for the construction of small electroplating tanks, techniques for bright acid copper and nickel plating, construction of variable low voltage power supplies, sources of electroplating supplies and references will be provided. Fee $15. Enrollment limited to 20 per session.

WK-14 CHEMCOM--UPDATE FROM THE FIELD TEST. S. A. Ware, Educational Services Department, American Chemical Society, Washington, D.C. 20036

Chemistry in the Community (CHEMCOM) is an alternative chemistry course for the general student at the high school level. CHEMCOM covers that chemistry needed by students concerned with understanding a series of community issues involving chemistry. These issues include water and air pollution, resource management, appropriate nutrition and health care, petroleum as a fuel and a feedstock, nuclear chemistry and its uses, and the role of the chemical industry on the local and national scene. CHEMCOM is currently being field tested in schools in 13 states around the country. This workshop will feature a series of CHEMCOM decision-making activities as well as several labs.

WK-15 ELEMENT OF THE WEEK-A DESCRIPTIVE CHEMISTRY TECHNIQUE. Elizabeth Horsch, Sue Berger, Allen Hill and Dick Holmquist - 1985 Dreyfus Institute Master Teachers. Sentinel H.S., Missoula, MT 59801.

> "To be liberally educated is to be knowledgeable, imaginative, articulate, and observant. To become liberally educated one needs something to be knowledeable, imaginative, articulate and observant about!"

Most of us would agree that this is the essence of education. In our science classes, however, we often fail to deal with the implied challenge of the second statement. Ideally science teaching should motivate students to explore, explain, probe and question. Most all students need to be given something to be imaginative and articulate about.

This paper describes a technique to initiate this process. Each week a different element is selected and its properties and reactions are explored. Students begin to develop an observational framework to support chemical theory. For the teacher it is enormously satisfying to be forced to introduce chemical concepts to explain why helium is such a dull element!

WK-16 WRITING IN SCIENCE COURSES, Tony Neidig and John Bean.

Design of short chemistry writing assignments, and rapid evaluation of student essays. Workshop leaders will follow up on problems and questions raised in the "Writing Across the Curriculum" sessions on Monday and Tuesday.

WK-17 WORKSHOP IN JEWELRY DESIGN FOR GRAPHITE SKETCHING AND ELECTROFORMING, Robert Coleman.

This workshop in jewelry design is a unique way to use graphite sketches to create pieces of jewelry to be electroformed in a bright acid copper bath. The workshop will include: design theory, sketching, electroforming, and glueing of stones to create an original piece of jewelry by each participant. Each individual will have one or more finished pieces of jewelry to take home. All materials needed for the workshop will be furnished.

WK-18 ENJOYING CHEMICAL DATA PROCESSING WITH "MINITAB", Gilbert Pollnow, Dept. of Chemistry, University of Wisconsin, Oshkosh, WI 54901

MINITAB is a powerful software program originally developed on a mainframe for students in introductory statistics courses at Penn State. It's capabilities have been expanded to the extent that it is now licensed world wide. It's use in Chemistry is a natural extension, since many problems involve data manipulation, various forms of correlations, regressions, tabulations, and graphics. The commands are similar to BASIC in form, but with each variable representing a whole column of data. Thus, the single command, REGRESS C3 2 C1 C4 C5 C6 performs a quadratic regression of the data in columns C3, C1, C4; with C5 the column of residuals, and C6 the fitted values of the Y-coordinates. The original and fitted data can both be plotted on the same graph with MPLOT C3 C1 C6 C1, or listed in columns with PRINT C1-C6. CORR C1-C6 generates the entire table of possible correlations between the six columns of data. MINITAB is now available for the IBM PC, and most other popular microcomputers with 256 K memories, and can be interfaced with LOTUS 1-2-3. The workshop will provide individual hands-on instruction on a variety of applications in the lecture and laboratory. Participants are urged to bring along any problems of interest. MINITAB is a registered trademark of Minitab, Inc.

WK-19 WORKSHOP ON CAS ONLINE. Adrienne W. Kozlowski, Department of Chemistry, Central Connecticut State Univ., New Britain, CT 06050 and Ronald J. Wikholm, University of Connecticut, Hartford Campus, West Hartford, CT 06117.

An introductory workshop on computerized online searching of Chemical Abstracts will be offered. Basic online searching skill for locating document references in CAN ONLINE files will be covered, with time available for hands-on practice searching. Information on Chemical Abstracts Service Academic Plan will be provided.

WK-20 NSF/ACS IN-SERVICE WORKSHOP. D. W. Brooks on behalf of the authoring team.

Expanded from original work by a group of Los Angeles area high school chemistry teachers, the NSF has supported the American Chemical Society in efforts to develop a chemistry enrichment program. The first tryout workshop will be held at Bozeman. Videodisc and computer materials will be shared with participants. Experienced teachers, especially those who might want to consider becoming workshop leaders in a future national in-service network, are welcomed.

WK-21 JCPDS-ICDD WORKSHOP ON X-RAY ANALYSIS, Jenkins R., McCarthy G., Smith DK.

The elements of X-ray spectrometry and diffraction will be reviewed. Use of modern computer-automated instruments and procedures for qualitative and quantitative analysis of crystalline solids will be illustrated with case histories. A discussion of the role of X-ray analysis in high school and college chemistry courses will take place and teaching tools (transparency masters, test banks, etc.) will be provided. The workshop will begin with a lecture on the application of X-ray analysis of the Shroud of Turin Project.

Not included in this tabulation are 3 CCCE workshops which are being conducted July 31st - August 2nd at the same site:

DESIGN AND DEVELOPMENT OF COMPUTER ASSISTED INSTRUCTION PROGRAMS

MICROCOMPUTER INTERFACING

THE COMPUTER AS A TOOL

For further information on these workshops, contact Dr. M. Lynn James, Department of Chemistry, University of Northern Colorado, Greeley, CO 80639 (303-351-1285). Housing for these sessions can be arranged through the conference.

COMPUTER PROGRAM CONTEST WINNERS

SERAPHIM Instructional Program Contest winnners are on display in the Software Evaluation Center, 272-273 Strand Union Building (SUB).

Computers in Chemical Education is running a Graphics Contest this year, and programs from this competition will also be on display at the meeting. Watch the newsletter for location, or ask at the Software Evaluation Center.

OTHER IMPORTANT LOCATIONS

Trading Post: Hopefully in Ticket Office by Ballroom A, Strand Union.

Software Evaluation Center: Rooms 271-272-273 Strand Union, Monday 28 July to Wednesday 30 July.

Exhibits: Ballroom A, Monday Noon (28 July) to Wednesday Noon (30 July).

Social Center, Coffee, Refreshments: Ballroom A, Strand Union, Sunday 27 July to Wednesday 30 July.